Innovation, Quality & Honesty

994-X Pre-Hanging Door System

Operation and Service Manual

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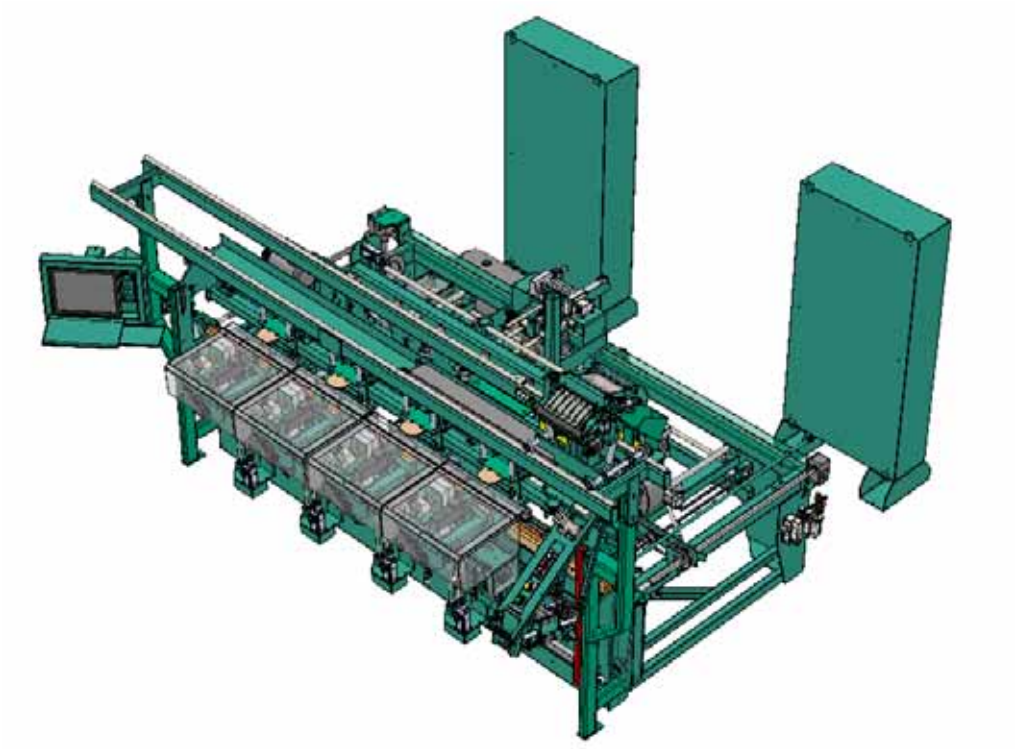

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CHAPTER 1 Introduction to the 994-X Door Hanging System

This chapter provides an overview of the KVAL 994-X Door Hanging System and important safety information to follow when operating the machine.

Chapter 1 at a Glance

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Overview of the 994-X Door Hanging System

KVAL's 994-X offers a high-speed pre-hanging line with the additional flexibility of servo controlled hinge routing sections. This includes high frequency spindles and programmable point to point pre-drilling.

The 994-X is designed for both interior, exterior doors and jambs. It will accommodate 1-3/8" and 1-3/4" thick doors with a minimum width of 18" and a maximum width of 42”. Door lengths of 6' 8" or 8' 0" can both be machined. Hinge locations automatically shift between two pre-determined factory set locations to accommodate both three hinge pockets (6’-8”) and four hinge pockets (8’). Changeover does however require manual repositioning of the jamb clamp fixtures but can easily be accomplished in under two minutes without the use of tools.

The door is power-fed into the machine and clamped into position. After the hinges are attached, and machining is finished, the door and jamb automatically is off-feed as the next door enters the machine

Hinge routing sections are completely servo controlled for pocket height, width, and depth. Each hinge routing section is equipped with two 1-1/2 HP High Frequency spindle motors, one for routing and one for pre drilling on both the door and jamb. Servo motors allow the hinge router to accelerate out of and decelerate into hinge corners eliminating over travel. Changeover from 3-1/2” to 4” hinges is accomplished by selecting the desired size on the touch-screen.Our Point to Point Pre-Drill system can be programmed to drill all common hinge patterns automatically. Additionally, the use of servo motors allows you to machine both 1/4” and 5/8” radius corners without changing out tooling.

Hinges may be attached manually or with the optional Six-Shooter to install 3-1/2" X 3-1/2" hinges, or the optional Eight-Shooter for attaching 4" X 4" hinges while the door and jamb remain clamped in position. Door-to-door productivity, including hinge mounting, is typically 35-55 seconds. However, this varies depending on the operator and material flow.

The lock machining assembly will be positioned with a single servo driven ball screw. This is controlled by the touch screen, and will allow settings for standard lock and dead bolt locations based on the lock bore location. A third dead bolt bore may easily be added by entering the position on the touch screen. The servo driven system will automatically position the lock boring assembly when the door hand is changed. Lock detailing includes 2-1/8” face boring with push button change over between 2-3/8” and 2-3/4” back sets; 1” bolt drill and face plate routing. Face plate routing will be accomplished with a 1-1/2 hp Hi-Frequency spindle motor.

The 994-X will accommodate doors with raised molding one or both sides up to 3/4" high, and a minimum of 4" between the raised molding and the edge of the door.

This machine is equipped with a solid state touch screen that replaces many of the mechanical switches for the machine functions. The touch screen also includes the capability to view the status of the various photo eyes and switches for quick diagnosis when needed, without having to open the electrical panel or for the operator to leave his work station. The Touch Screen logic also includes management functions such as Daily and Lifetime Totals.

About the Six Shooter

The 6- Six-Shooter screw gun will attach 3-1/2" X 3-1/2" hinges to the door and jamb, # 9 X 3/4" long flat head screws are automatically sorted and fed, six at a time, to the screw gun. The operator manually places the hinge onto the magnetic indexing fixture and then rolls and pivots the Six Shooter into an "H" block at each hinge location to attach the hinges. Pressing the 'Reset' switch then raises the Six Shooter and feeds a set of six screws for the attachment of the next hinge.

The Six Shooter, which is supported on ball bearing equipped steel wheels and is mounted on an overhead track. The track and the Six Shooter are precisely aligned to ensure the hinge is properly position into the pocket at each hinge location.

Option Z: Screw-Changing Hopper for Six Shooter.Screw-changing hopper for changing screw colors.

994-X Available Options:

Option R1: Push Button Quick Change 0 or 3 Degree Hinge Routing. Price includes PLC logic and controls to allow front hinge routing section to rout on either a 0 degree or 3 degree angle. Hinges will be flush mounted when installed on doors with either square edge or 3 degree bevel on hinge side.

Option O: Door Blow-Off System.Air blow-off tube cleans dust and chips from top of door.

Option V: Narrow Door Center Wheel Support. Supports doors under 16" and allows machining on either lock or hinge side with the use of a side shim. This option has controls to set the width at 12.0" , 14.0", and 16.0" Shim is not included.

Option W: Hinge Stops for 6'8", 7'0" & 8'0" Doors. This option is limited to certain hinge pocket locations ~ Consult with your KVAL sales representative.

Option SE: Single Electrical Drop. Price includes a disconnect mounted on one electrical box that will power both 994-X Electrical boxes. Price includes wiring from the disconnect to each box

About this Manual

This manual contains operation information and service and maintenance information.

It includes identification of machine assemblies, power-up and power-down steps, and information about using the user interface.

The Troubleshooting and Maintenance sections are directed toward qualified service technicians

TABLE 1- 1.

Title	Part Number
994-X Operation and Service Manual	204_OPSRVDOC_994x

Safety First!

This machine is a powerful electro-mechanical motion control system. You should test your motion system for safety under all potential conditions. **Failure to do so can result in damage to equipment and/or serious injury to personnel.**

Safety Sheet Sign-Off Sheet

At the end of this chapter, there is a safety sign-off sheet. It lists personnel and machine safety criteria to understand before operating the machine. It is highly recommended that personnel operating, working on a machine meet the criteria listed in this sheet. It is recommended the sheet be signed and kept for records. See “Safety Sign-Off Sheet” on page 1-16.

Safety Terminology of Labels

In addition to the nameplate, KVAL machines may have other warning labels or decals that provide safety information to operators. Safety labels should be clearly visible to the operator and must be replaced if missing, damaged, or illegible.

There are three types of warning labels or decals:

- **DANGER** means if the danger is not avoided, it will cause death or serious injury.
- **WARNING** means if the warning is not heeded, it can cause death or serious injury.
- **CAUTION** means if the precaution is not taken, it may cause minor or moderate injury.

Safety Guidelines

In addition to the caution and warning labels affixed to this machine, follow the guidelines below to help ensure the safety of equipment and personnel.

Training

WARNING
Read and understand operator's manual before using this machine.
Failure to follow operating instructions could result in injury or damage to equipment.

Ensure that all employees who operate this machine are aware of and adhere to all safety precautions posted on the machine and are trained to operate this machine in a safe manner.

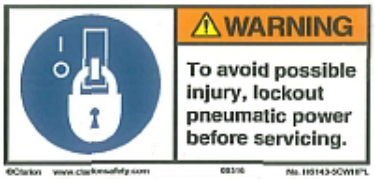
Protective Gear

Never operate the machine without proper eye and ear protection.

When the Machine is ON

- **Never** reach hands beyond safety cage. Servo motors can unexpectedly move quickly.
- **Never** clear screws or hinges out of the machine while it is running.
- **Never** reach into the router area to retrieve a hinge. The router may still be running down after shut down.
- **Never** perform any maintenance unless machine is at zero state.
- **Never** clean the machine while it is running.
- **Never** walk away from the machine while it is running.

Compressed Air



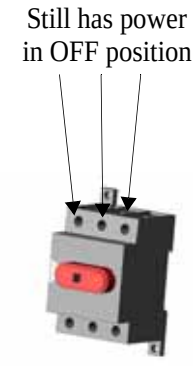
The compressed air system connected to this machine should have a three-way air valve for shut-off and pressure relief.

All cylinders on machine are under high pressure and can be very dangerous when activated. Before performing any maintenance or repairs on this machine turn off the main air disconnect. **Lockout and tagout this connectio**n.

See “Lockout Tagout Procedure” on page 1-8.

Electrical

Electrical circuitry on this machine is protected by an approved lockable disconnect circuit. In addition to this equipment, you must install an approved disconnect for the electrical power supplying this machine.



When opening the cabinet you must first turn off the disconnect switch. When the cabinet door is open there is **still power on the top side of the disconnect switch**. Some machines are powered by more than one supply located at different locations. Before performing any repairs or maintenance, lockout and tagout **must be installed at all locations**

All maintenance and repairs to electrical circuitry should only be performed by a qualified electrician.

Before Conducting Maintenance

Prior to performing any maintenance, repairs, cleaning or when clearing jammed debris, you must disconnect, tag out, or lock out the electrical and air pressure systems. This should be done in accordance with applicable state and/or federal code requirements.

Compliance with Codes and Regulations

KVAL advises that you request an on-site state safety review of your installation of this machine. This is to ensure conformance to any additional specific safety and health regulations which apply in your geographic area.

Other Hazard Control Action

Report a Hazard

Before You Report an Accident

If you believe any part or operation of this machine is in violation of any health or safety regulation, **STOP** production. It is your responsibility to immediately protect your employees against any such hazard.

Additional detailed safety guidelines are included in the operating instructions of this manual. KVAL will be pleased to review with you any questions you may have regarding the safe operation of this machine

Follow Your Company's Safety Procedures

WARNING
Read and understand operator's manual before using this machine.
Failure to follow operating instructions could result in injury or damage to equipment.

In addition to these safety guidelines. Your company should have on-site and machine specific safety procedures to follow.

Lockout Tagout Procedure

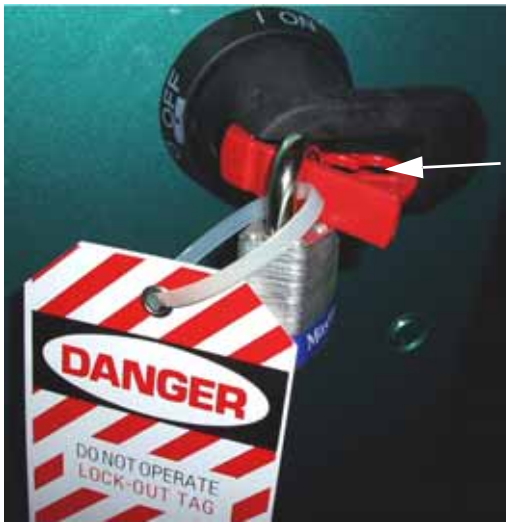
This policy is required by OSHA regulation 1910.147 and Cal OSHA'S SB198 ruling of July 1991.

Use the following lockout procedure to secure this machine while it is powered down. During a lockout, you disconnect all power and shut off the air supply. Be sure to use the tagout guidelines noted below.

To Lockout the This Machine

1. Assess the equipment to fully understand all energy sources (multiple electrical supplies, air supply and pressure, spring tension, weight shifts, etc.).
2. Inform all affected personnel of the eminent shutdown, and the duration of the shutdown.
3. Obtain locks, keys, and tags from your employer's lockout center.
4. Disconnect power:

   a. Turn the disconnect switches on the main electrical panel to the OFF position. Then pull out the red tab and place a padlock through the hole. Place your tag on the padlock, as per the tagout guidelines below. (see illustration below).



When multiple people are working on the machine, each person needs to have a lock on the handle in the extra holes provided.

   b. Turn the disconnect switch on the larger high-frequency panel to the OFF position. Then pull out the red tab and place a padlock through the hole. Place your tag on the padlock, as per the tagout guidelines below.

5. Turn the main air valve to the OFF position and place a padlock through the hole (see illustration below).

NOTE: Place your tag on the padlock, as per the tagout guidelines below.

6. Once the locks and tags are in place and all personnel are clear, attempt to operate the machine to ensure equipment will not operate.

7. Maintenance or repairs may now be completed. The person performing the work must ensure all tools, spare parts, test equipment, etc., are completely removed and that all guards and safety devices are installed.

8. Before removing the locks and tags, the person who attached them shall inspect the equipment to ensure that the machine will not be put in an unsafe condition when re-energized.

9. The lock and tag can now be removed (only by the person(s) who placed them), and the machine can be re-energized.

10. The tags must be destroyed and the locks and keys returned to the lockout center.

Lockout-Tagout Guidelines

- Place a tag on all padlocks. On a tag, each operator must put their own name and date. (These locks are only to be removed by the person who signs the tag)
- If more than one person is working on the machine, then each additional person places a lock and tag on each disconnect.
- Only each operator may remove their own lock and tag.

Important: When many people are all working on the same machine you will need a multiple lockout device, such as the one shown here.

Follow the P-R-O-P-E-R lockout rule of thumb.

P..... Process shutdown

R ..... Recognize energy type (electrical, pneumatic, mechanical, etc.)

O..... OFF! Shut off all power sources and isolating devices

P..... Place lock and tag

E..... ENERGY: Release stored energy to a zero-energy state

R ..... Recheck controls and test to ensure they are in the “OFF” state

Zero-Energy to Start-Up

Zero-Energy State to Start-Up to Operating State

Starting the equipment properly is just as important as the lockout/tagout guidelines in terms of safety.

Start-up Guidelines

The following guidelines below should be followed to start the equipment.

Inspect

The equipment must be inspected for proper adjustment before starting equipment.

Clean Up

All materials and debris must be cleaned up. Any combustible materials or old parts used during repairs must be cleaned up and/or properly disposed of.

Replace Guards

Replace all equipment guards. If part of equipment cannot be properly adjusted after start-up with guard on, contact the KVAL Service team. See “Contacting KVAL” on page 1-2.

Check Controls

Confirm that all switches are in the “OFF” position. Please be advised that some components of the machine may start automatically when energy is restored.

Remove Locks

Each operator must remove his or her own lock and tag. This will ensure that all operators are in a safe place when the equipment is started.

Perform Visual Checks

If the equipment is too large to see all around it, station personnel around the area and sound the personnel alarm before starting the equipment. If your operation is more complex, your company’s comprehensive safety procedure may involve additional steps. You will need to ask your supervisor about these procedures. The company’s lockout procedure should be posted at each machine. On larger or long-term maintenance or installation projects, the company’s procedures must be explained to all new operators and a copy of the company’s procedures should be posted on-site for the duration of the work.

The Company’s procedures should also include provisions for safely handling shift changes and changes in operators or new operators.Comprehensive lockout/tagout

may use a gang box or other system to ensure that locks are secure and not removed without authorization.

Remember, lockout/tagout procedures work because you are the only one with the key to your lock. Proper lockout/tagout can save lives, limbs, and money. Help make your work environment safe for you and your fellow workers. Be sure to follow the P-R-O-P-E-R lockout/tagout procedures, and that those around you do also.

Close the Cage Gate

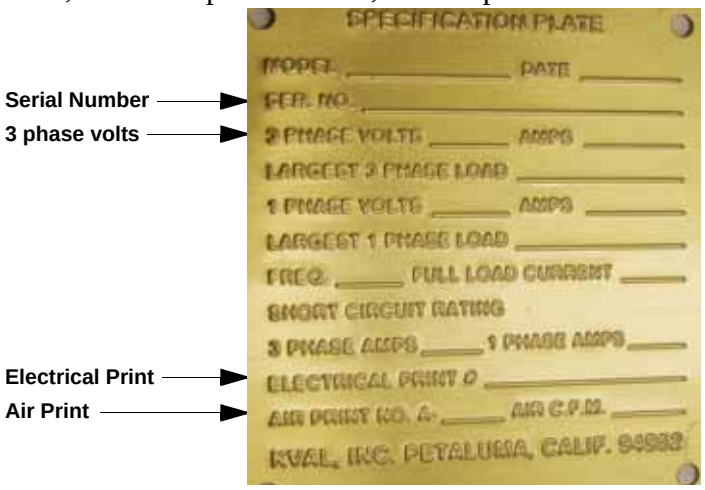
Verify all cage gates are securely closed. Ensure all safety protocols are in effect.

Getting Help from KVAL

Before you seek help, first try the troubleshooting procedures. Follow the procedures below.

If you are unable to resolve the problem:

1. Locate the machine's Specification Plate and record the serial number, 3 phase volts, electrical print number, and air print number.



2. Contact our customer support team:

- In the U.S and Canada, call (800) 553-5825 or fax (707) 762-0485
- Outside the U.S. and Canada, call (707) 762-7367 or fax (707) 762-0485
- Email address is service@kvalinc.com
- Hours:

  6:00 AM to 4:00 PM Pacific Standard Time, Monday through Thursday

  6:30 AM to 1:30 PM Pacific Standard Time, Friday

On-Line Help

On machines with a Beckhoff® PLC and an internet connection, our service team are able to connect, run, and troubleshoot your machine. Ask about this procedure when calling are service team.See Chapter 3 "System IT Administration" on page 3-1, for more information.

Product Return Procedure

If you've contacted Kval for help and it is determined that a return is necessary, use the procedure below to return the machine or part.

Note: Non-Warranty returns are subject to a 15% restocking charge.

1. Obtain the packing slip and/or invoice numbers of the defective unit, and secure a purchase order number to cover repair costs in the event the unit is determined to be out of warranty.

2. Reason for return: Before you return the unit, have someone from your organization with a technical understanding of the machine and its application include answers to the following questions:

- What is the extent of the failure/reason for return? What are the relevant error messages or error codes?
- How long did it operate?
- Did any other items fail at the same time?
- What was happening when the unit failed (e.g., installing the unit, cycling power, starting other equipment, etc.)?
- How was the product configured (in detail)?
- Which, if any, cables were modified and how?
- With what equipment is the unit interfaced?
- What was the application?
- What was the system environment (temperature, spacing, contaminants, etc.)?

3. Call Kval customer support for a Return Material Authorization (RMA). When you call:

- Have the packing slip or invoice numbers available.
- Have the documented reason for return available.

4. Send the merchandise back to Kval.

- Make sure the item(s) you are returning are securely packaged and well protected from shipping damage
- Include the packing slip or invoice numbers.
- Include the documented reason for return.
- Include the RMA number with the parts package.

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Safety Sign-Off Sheet

Machine Model Number:_____

A Note to the Operator:

This machine can help you be highly productive only if you understand how to use it properly and follow the safe operating practices described in this document and the machine's manual. If you do not understand the machine's proper operation or ignore the safe operating practices, this machine can hurt or kill you. It's in your best interest to safely and properly operate this machine.

Personnel Safety Concerns:

- I have been properly trained in the operation of this machine.
- I will always wear ear protection when operating this machine.
- I will always wear eye protection when operating this machine.
- I will never wear loose clothing or gloves when operating this machine.
- I will watch out for other people. Make sure everyone is clear of this machine before operation.
- I will always follow my company's safety procedures. I have read and understand these guidelines.

Machine Safety Concerns:

- I have been given a tour of the machine and understand all the safety labels, E-Stops and the actions to take in case of an emergency.
- I will make sure all guards are in place before operation
- I will turn off the compressed air, before loading hardware (staples, screws, etc)
- I will turn off the electrical power, for setup
- If the machine should operate in an unexpected manner stop production I will immediately and notify a manager, a supervisor, or a qualified service technician.

I have read and understand this document and agree to operate this machine in a safe manner as described above.

Employee

Name (print):_____ Signature: _____ Date:____/____/____

Supervisor/Safety Officer/Trainer

Name (print):_____Signature: _____ Date:____/____/___

Note: It is recommended you make a copy of this sheet for new operators. If a copy is needed, you may download a PDF at the KVAL website (http://www.kvalinc.com). You may also contact our Service Department at (800) 553-5825 or email at service@kvalinc.com.

CHAPTER 2 Operation of the 994-X

This chapter describes components, assemblies, and the user interface of the *KVAL 994-X Door Hanging System.* The content is geared to help operators understand the basic operation of the 994-X. Included are instructions to calibrate the machine and process a door.

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Operator's Tour

This section takes you on a tour of the *994-X Pre-Hanging Door* machine. 994-X

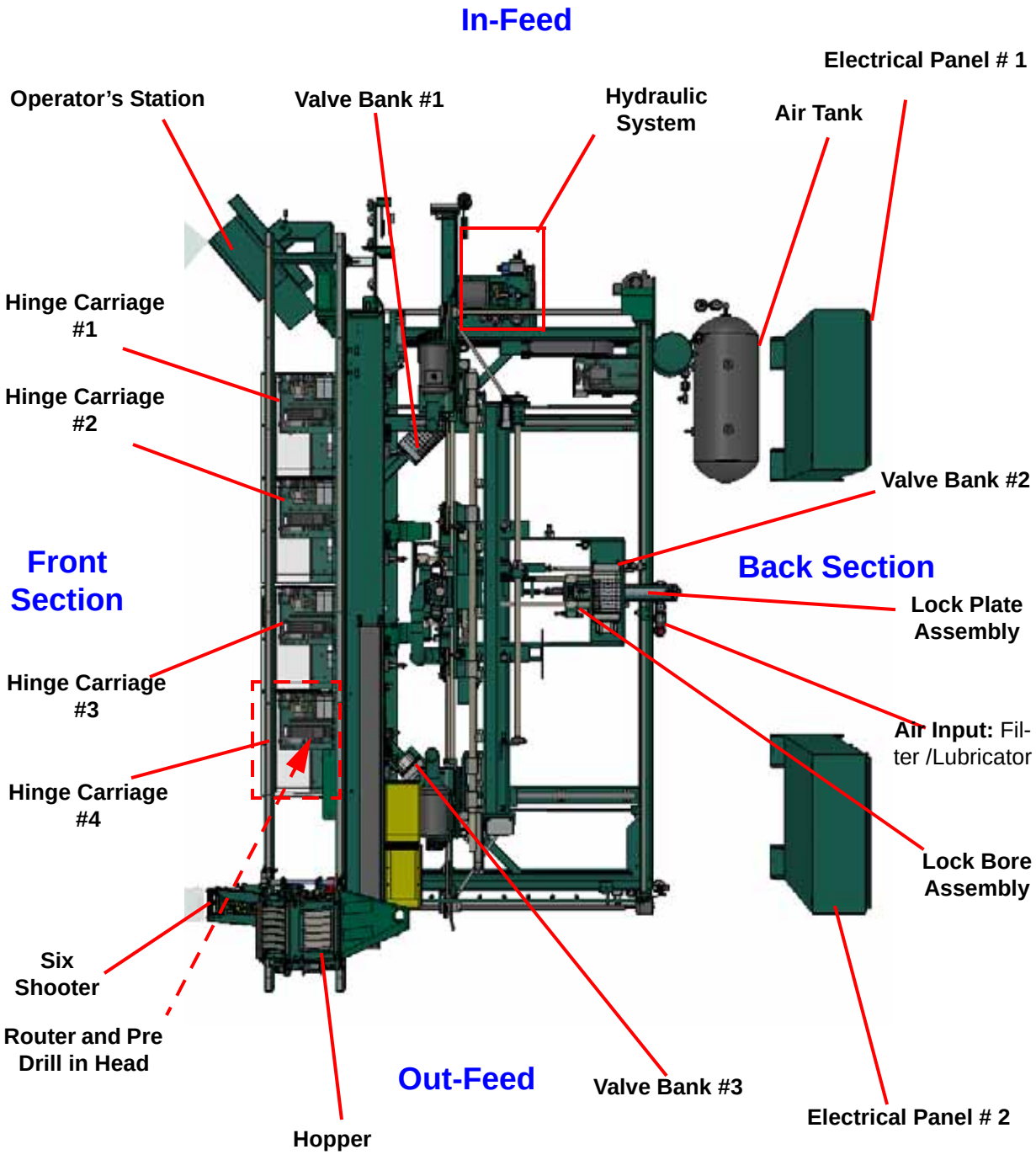


FIGURE2- 1. **Identification of Key Assemblies of 994-X**

About the 994-X

The 994-X will:

- Machine a hinge pocket on a door and jamb for up to 4 hinges (Head Assembly)
- Drill pilot holes for the hinge screws (Head Assembly)
- Apply up to 4 hinges.(Six Shooter)
- Attach the hinges with screws (Six Shooter)
- Cut a lock and lock plate (Back Section)

In-Feed Section:

- Door is input from previous machine
- Includes automatic door width adjustment
- Door is feed through machine for processing
- The door is automatically positioned while the operator loads and clamps the door and jamb.

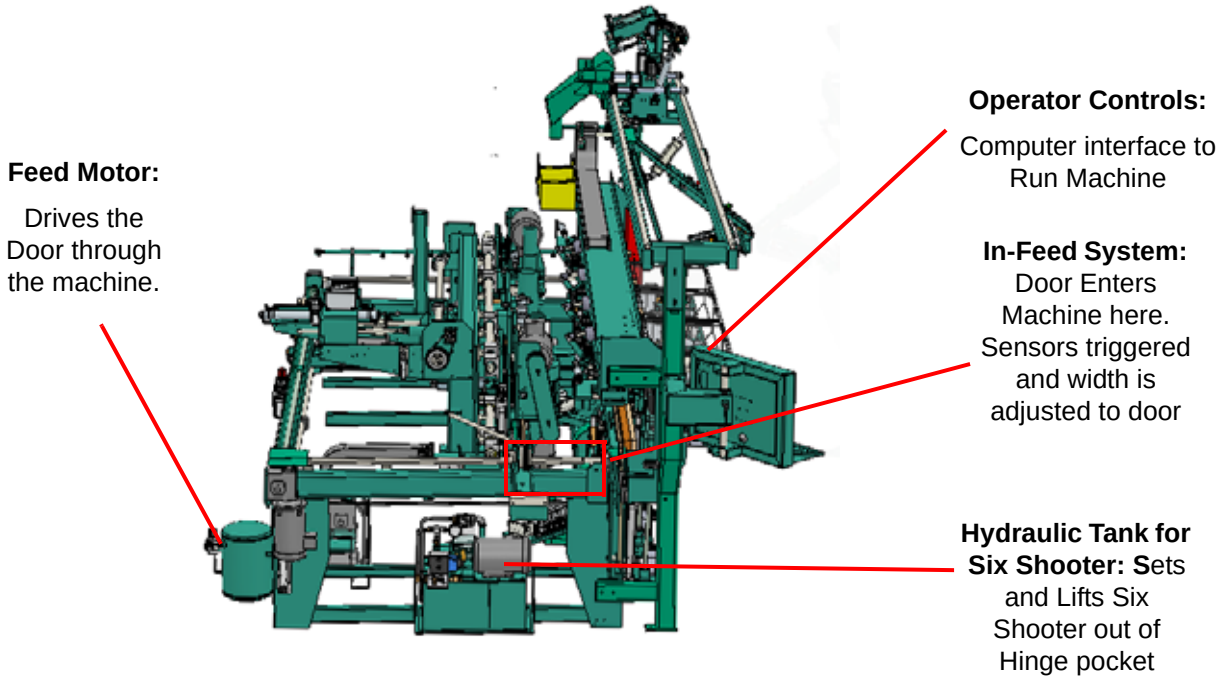
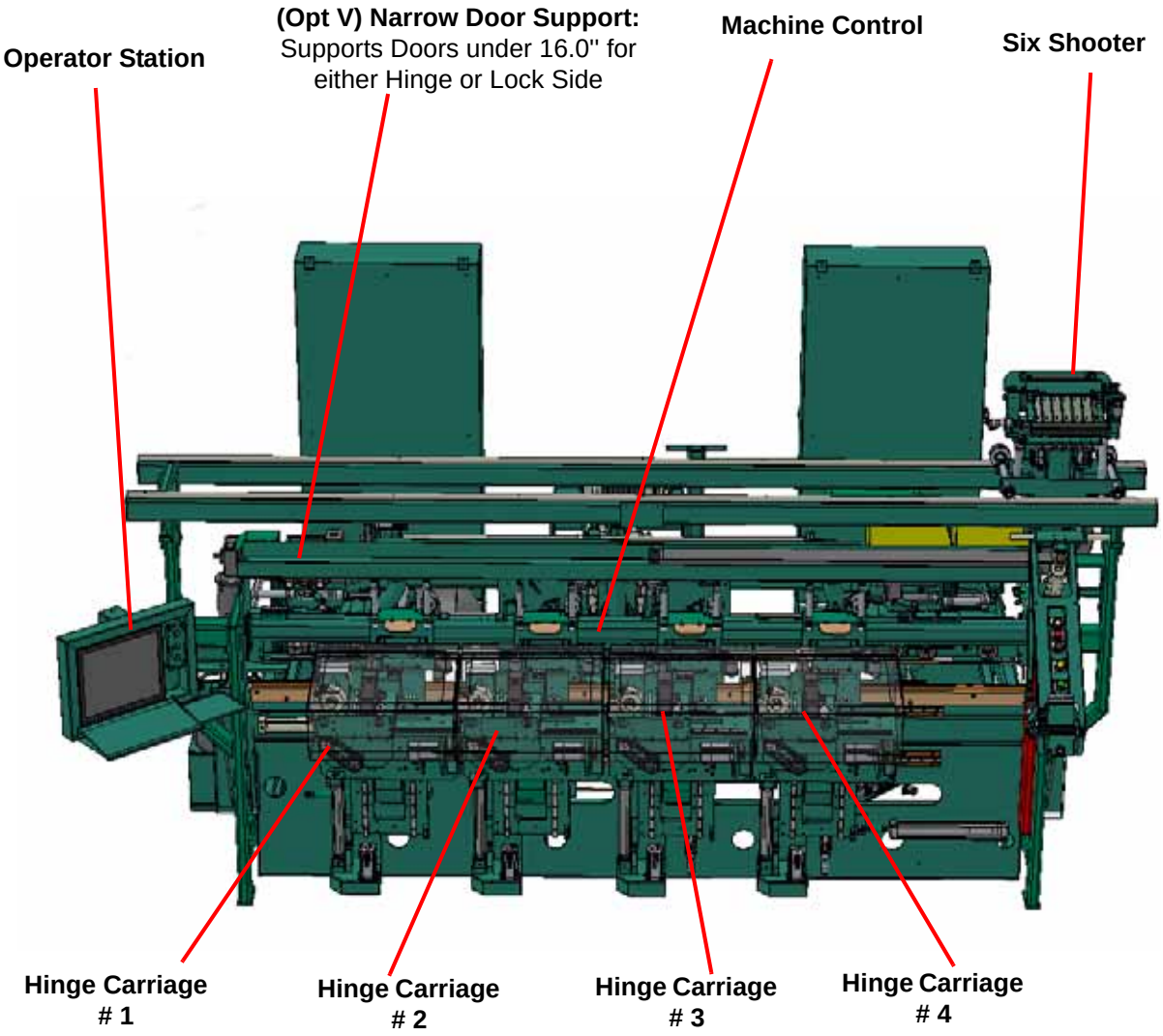

Feed Motor:
Drives the Door through the machine.
Operator Controls:
Computer interface to Run Machine
In-Feed System:
Door Enters Machine here. Sensors triggered and width is adjusted to door
Hydraulic Tank for Six Shooter: Sets and Lifts Six Shooter out of Hinge pocket

FIGURE2- 2. Key Assemblies on the In-Feed Section

Front Section

The Front Section contains:

- Operator Station
- Six Shooter
- Machine Control
- Hinge Carriages 1 through 4



Operators Station

The Operator Station contains a touch screen that allows communication between the operator and the machine. Through automation, the station interface replaces manual setup, thereby saving time. Door cutting parameters can be stored and retrieved by one touch.The Touch Screen logic also includes management functions such as Daily and Lifetime Totals. See "Description of User Interface Screens" on page 2-25 and"Quick Start" on page 2-20 for more information.

Touch Screen Interface

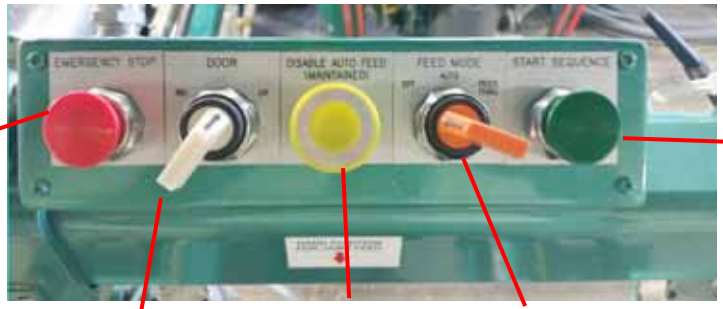
Controls:

- Emergency Stop
- Start "boot-up" and Stop
- Lock Out ability to change programs
- Turn ON or OFF Control Transformer

FIGURE2- 3. Operators Station with touch Screen Interface

Machine Control

The machine control is located is centrally located for easy access. The control works with the Operator Interface to process a door. The controls are listed in the illustration below. See "Quick Start" on page 2-20 , for more information on using this control in machining a door.



Emergency Stop: If Safety issues occur press this button

Start Sequence: Starts the sequence of machining a door

LH/ RH Door: Select a Right Hand or Left Hand Door

Disable Auto Feed: Stops Door Feeding Through

Feed Mode: Chose Auto, OFF, or instant feed thru

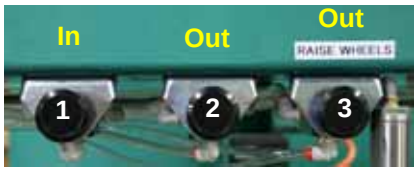
FIGURE2- 4.

Narrow Door Support (Option V)

This option supports doors under 16" and allows machining on either lock or hinge side with the use of a side shim. This shim is not included. The controls include 3 knobs to raise the wheels and adjust the width to 12.0", 14.0", and 16.0". Set the controls as shown below to the following order for the desired width. Knobs 1 and 2 adjust the width. Knob 3 raises the wheels.

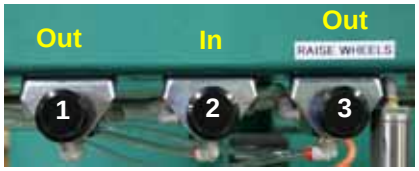
12.0 Inch

1. Push In
2. Pull Out
3. Pull Out



14.0 Inch

1. Pull Out
2. Push In
3. Pull Out



16.0 Inch

1. Push In
2. Push In
3. Pull Out

To process doors, it is recommended to manually put two doors with the same width side by side. The second door will act as a shim and allow machining on both sides of the door (lock and hinge pocket) if desired. It is important to keep the doors together, try clamping the doors together.

1. Turn off the **Auto Feed** select the either right hand or left hand from the control bar on the middle front of the machine.
2. Manually put door stop up.
3. Set the control buttons to the desired width. See the figure above.
4. To make minor adjustments to the width on the machine, measure the doors and measure from the brass of the H block to the back fence of the machine.

5. To allow room for doors to be fed in, use manual width adjust width to the **measurement plus 1.0''.** See "Width Adjust Operation" on page 2-37
6. Manual feed doors from the **out-feed** to the door stop at the in-feed.
7. Align the doors of needed.
8. Clamp door and jamb.
9. Perform normal steps to machine the door (s). See "Quick Start" on page 2-20

If machining both sides of the doors, flip the doors over to machine the other edge the doors. Ensure the doors are side by side as close to the original setup. Re perform steps 1 through 9.

Hinge Carriage

There are 4 Hinge Carriages on the front section. Each carriage includes:

- A router to automatically rout a hinge pocket on the door and jamb.
- A pre-drill to drill pilot holes in the hinge pockets to ready the insertion of screws by the six shooter

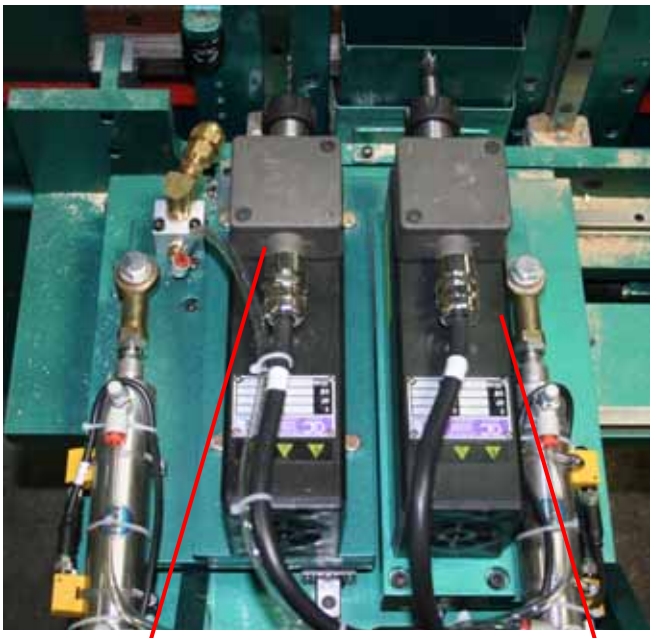

Pre-Drill:
Drills pilot holes for insertion of screws on the jamb and the door
Router: Routs the hinge pocket on the jamb and the door at the same time as the counter rotate router.

FIGURE2- 5. Hinge Carriage Parts

About the Six Shooter System

The Six Shooter system simultaneously drives six screws into the jamb and the door to attach the hinges.This section describes the assemblies of the Six Shooter. Below is a general description of how to use the Six Shooter.

1. Screws are poured into the Hopper at the top of the machine, where they are automatically sorted.
2. Six screws are air injected though tubes to the screw gun at the bottom of the six shooter.

3. The Six Shooter is mounted on an overhead track that is precisely aligned to ensure the hinge is properly position into the pocket at each hinge location.

4. The operator:

   a. places a hinge to the magnetic indexing fixture

   b. rolls the Six Shooter over to the hinge location and pivots it into the "H" block.

   c. drives all six screws into the door and jamb.

   d. presses the 'Reset' switch then raises the Six Shooter and retracts screw drivers out of the pocket

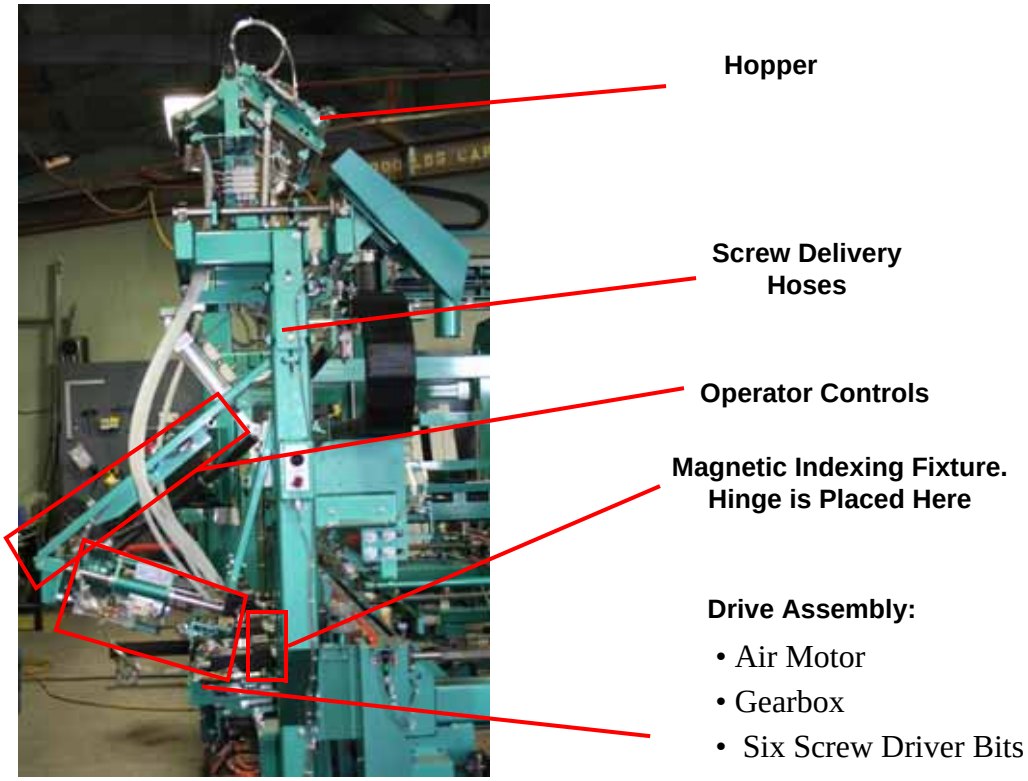


FIGURE 2-6. Photo of Six Shooter on the 994-X

About the Six Shooter Controls

Clear Screws:
If screws get jammed in the six shooter, press to clear the line. Pull away from the machine and press the button cause air blasts in the line.

Reset:
Reset raises the Six-Shooter, putting all the cylinders back in the Start position.

NOTE: If tilt cylinder is set to retract too fast, it can cause the Six Shooter to jump out of the pocket and bounce on the top rail

Insert Screw:
When the Six-Shooter is in the pocket position and the operator has inserted a hinge into the screw receiver block hinge holder you are now ready to insert screws.

Load / Unload:
If equipped with quick dump hopper (OPTIO Z), this button would be used to operate this option.

Unclamp:
Allows the operator a choice to release the door either from a foot pedal or a Six-Shoote mounted mushroom button.

Start Sequence:
The start sequence drops the Six-Shooter int the pocket while starting motor for hydraulic It also drops the screws down aided with air injection (if equipped) to speed the screw fee process

Hopper Slide Valve:
The hopper slide valve provides the operator a remote air shut-off that controls air flow to the screw hopper to aid in un-jamming debris in the screw drop zone.

Safety Insert Screw Slide Valve:
The insert screw slide valve provides the operator a remote air shut-off to prevent the Six-Shooter head from moving in when performing maintenance on the screw driver assembly. It also is a good practice to shut slide valve OFF when not in use.

Screw Driver in close trap
This allows the Six-Shooter to hold the Apex bits in close to the screw receiver tubes. This prevents the screws from bouncing out during the screw application. It is also helpful when replacing bits or doing maintenance on 3-degree bevel front section. Just plunge the head and flip the trap out of position. This will allow the head to retract to the back position.

FIGURE 2-7. **Identify Controls on the Six Shooter**

About the Hopper

The Hopper sorts the screws for delivery to the screw gun. The Hopper is attached to the Frame Interface which in-turn is attached to the Six Shooter.The Frame Interface allow the six shooter assembly to move across the machine.

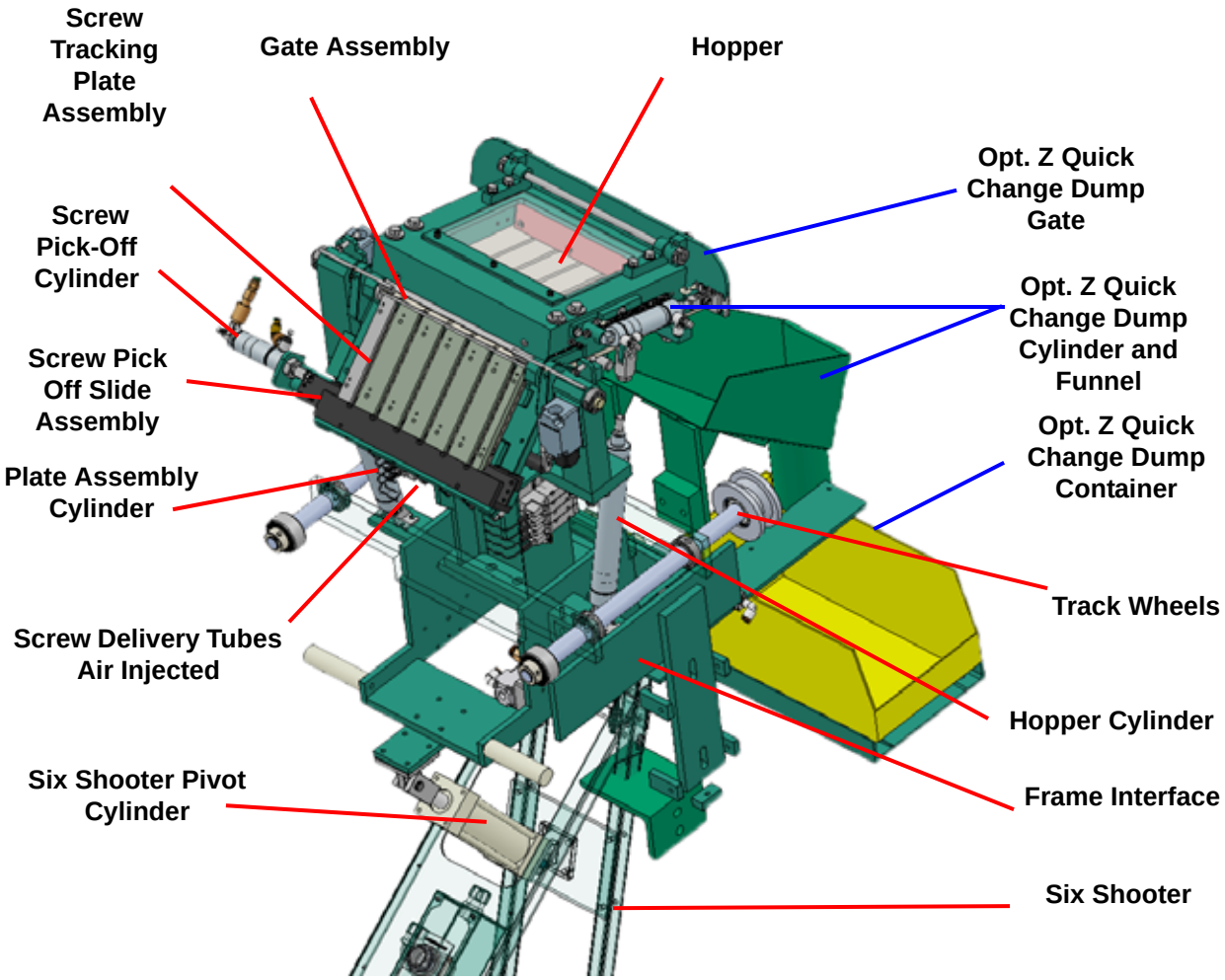


FIGURE2- 8. **Hopper and Frame Interface**

Important: Do not adjust any of the Hopper air cylinders. They are adjusted at the factory. Any adjustment may cause timing issues with the operation of the Six Shooter. If you think problems are being caused by the cylinders, please contact the KVAL Service Department for direction.

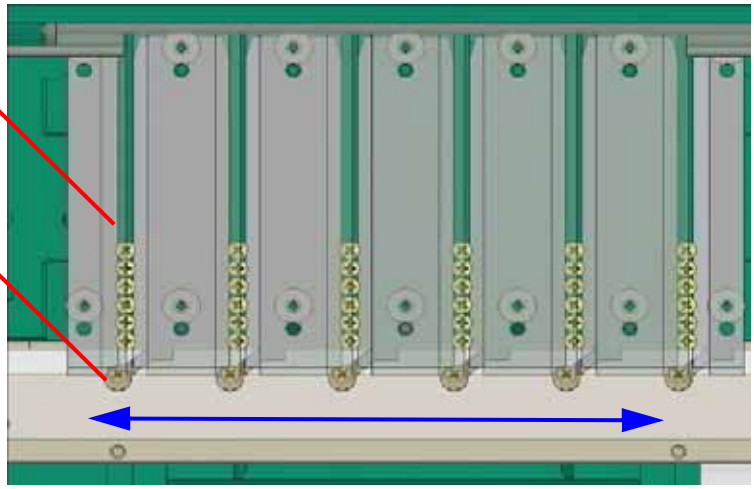
Important: Do not put Magnetized Screws in Hopper. Magnetized screws can cause sluggish response to screws getting stuck. Hopper plates could get magnetized and will have to be demagnetized with a degausser.

Hopper Process

1. Pour Screws into the **Hopper.**

   Note: The recommended maximum amount of screws a quantity of 600.

2. The **Hopper** moves the **Hopper Cylinders** up and down at the start of the process. This organizes the screws and delivers them to the **Screw Tracking Plate**.
3. The **Gate Assembly** monitors the quantity of screws delivered to the to the **Screw Tracking Plate Assembly**.
4. The screws are stacked in the slots of the **Screw Tracking Plate Assembly.**
5. The **Screw Pick Off Cylinder** moves the **Slide Assembly** to capture screws six at a time.



6. Press **Start Sequence** on the Six Shooter Control panel to activate the Slide Assembly to drop the screws into the **Screw Delivery Tubes.**
7. Each tube has air injectors to speed the delivery to the **Screw Receiver Tubes**.

Quick Change Process

Some Six Shooter Systems have an a quick change option to quickly change to different colored screws. To start the quick change process:

1. Park the Six Shooter.
2. Press the **Load/Unload** button on the Six Shooter panel.

   The back section of the Hopper will cycle upward once to shift all the screws from the back door to clear screws between the back door of the hopper and the slides.
3. Once the Hopper is in the up position, the door will open and the Hopper will cycle down quickly to throw the surplus of screws out the funnel container.

4. Once in the back section is in the down position, the front section (**Screw Tracking Assembly**) moves upward to drain the rest of the screws out of the hopper this will cycle one more time to clear the screws from the slides.
5. Press the **Reset** button on the Six Shooter panel located mid machine on the front section.
6. Fill the Hopper with new screws.

Driver Assembly

The Driver Assembly is the workhorse of the Six Shooter. The assembly automatically receives, aligns, and drives the screws into the door and the jamb.

Hydraulic Motor

Gearbox:

Geared to drive 6 screws simultaneously

Chucks X6:

Holds 6 screws aligned to the Door and the Jamb.

Hinge Applicator:

Location to attach Hinge

Turret to Adjust Depth:

Adjustable stops to set the depth of the screw drivers. Used with the Forward Limit Switch.

Plunge Cylinder:
Moves the screw drivers into place

***Forward Stop Limit Switch**

***Reverse Stop Limit on other side**

Magnets:

Four Magnets hold Hinge for Application.

Screw Receiver Tubes:

These tubes receive the screws from the hopper by way of plastic tubes

Split Shells X6:

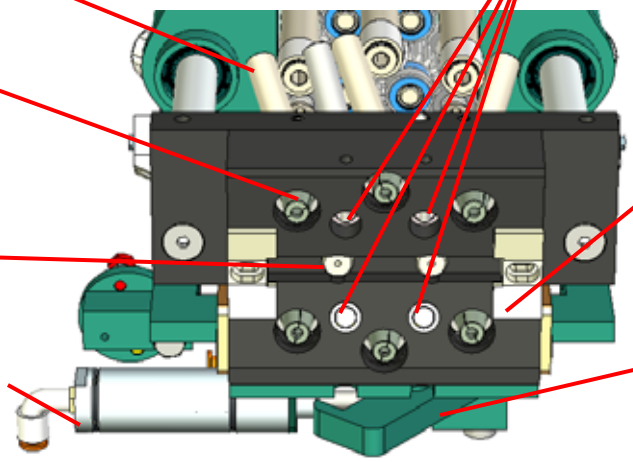
Receives 6 screws, straightens, and aligns them.

Index Spacers X2:

Factory set to align hinge.

Latch Arm Cylinder:

Moves latch arm in and out of position



Hinge Indexer X2:

Factory set to align hinge.

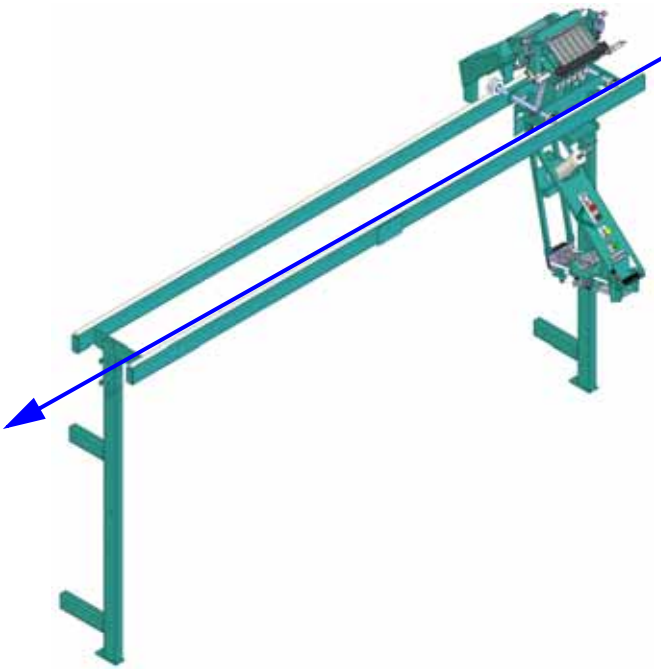
Latch Arm:

Latches to H Block to secure in place.

FIGURE2- 9. Six Shooter and Gear Box Call-Outs

About the Overhead Track

The Six Shooter, which is supported on ball bearing equipped steel wheels and is mounted on an overhead track. The track and the Six Shooter are precisely aligned to ensure the hinge is properly positioned into the pocket at each hinge location.



Back Section:

- Works in partnership with front section process
- Includes faceplate routing
- Includes boring for lock and bolt.

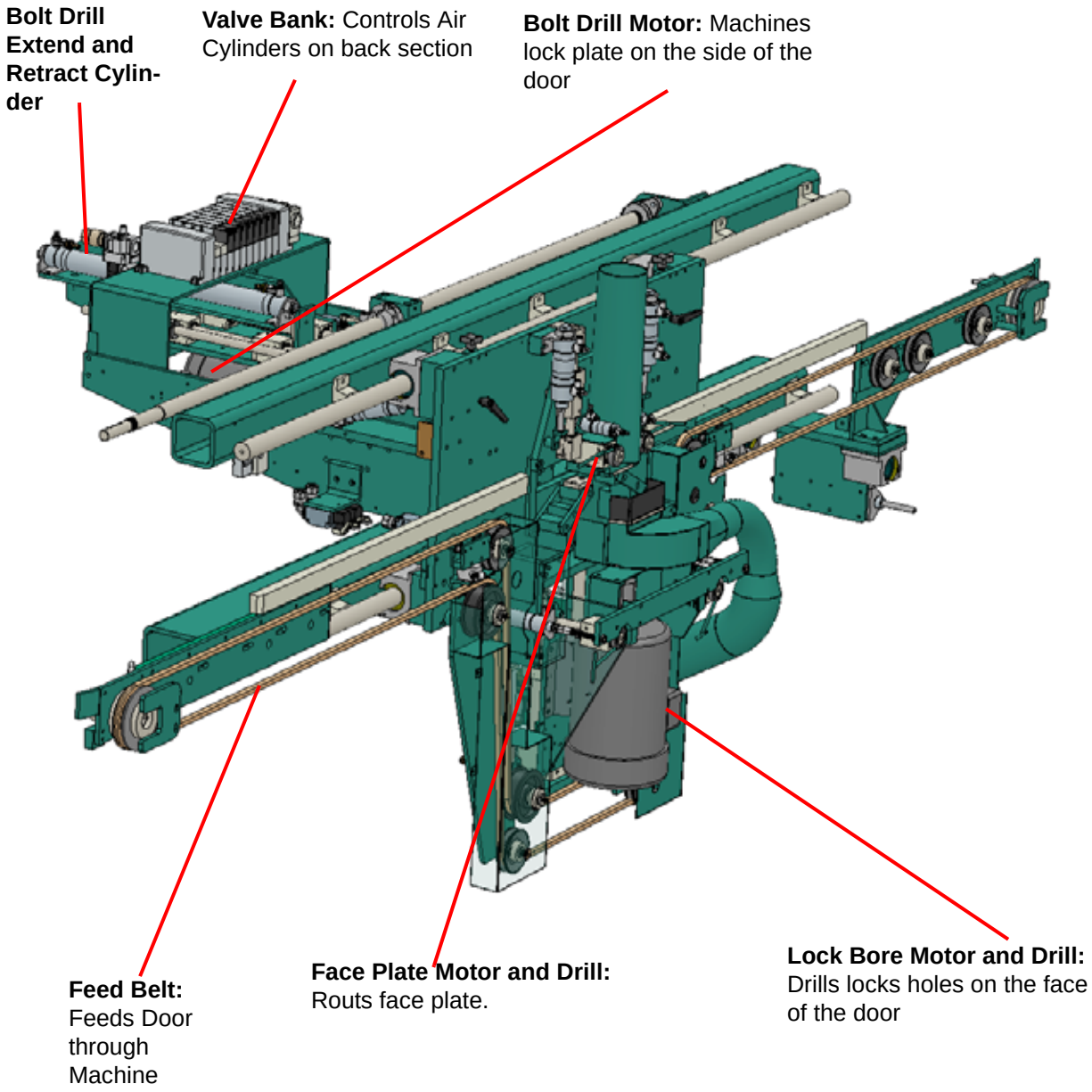

Bolt Drill Extend and Retract Cylinder
Valve Bank: Controls Air Cylinders on back section
Bolt Drill Motor: Machines lock plate on the side of the door
Feed Belt: Feeds Door through Machine
Face Plate Motor and Drill: Routs face plate.
Lock Bore Motor and Drill: Drills locks holes on the face of the door

FIGURE2- 10. Key Assemblies on the Back Section

Out-Feed:

- The door is automatically positioned to be fed into the next machine

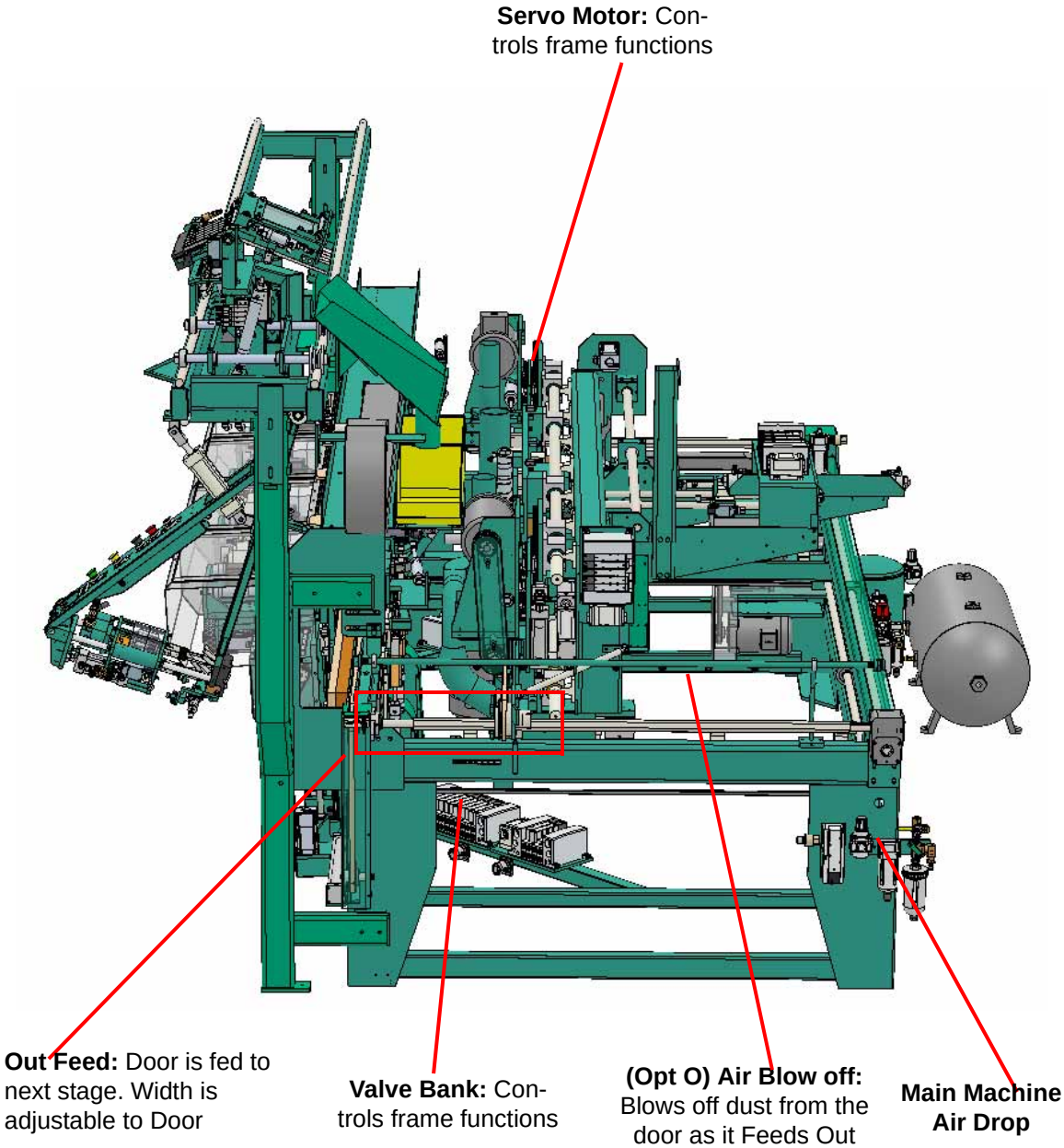

Servo Motor: Controls frame functions
Out Feed: Door is fed to next stage. Width is adjustable to Door
Valve Bank: Controls frame functions
(Opt O) Air Blow off: Blows off dust from the door as it Feeds Out
Main Machine Air Drop

FIGURE2- 11. Key Assemblies on the Out-Feed Section

About the Electrical Panels

The 994-X has a Main Electrical Panel and a High Frequency Panel. Figure 2- 12 below, is an overview of the location of assemblies in the panels.

The Main Electrical Panel:

- Supplies voltages to the machine
- Contains the PLC (Programmable Logic Controller)
- Contains servo drives to interact with the servo motors (Axis and Lock Location) in the front and back sections

The High Frequency Panel

- Supplies voltages to the machine
- Contains the PLC interface
- VFDs (Variable Frequency Drives) to interact with hinge and faceplate routers, width adjust motors, and feed motors

Warning: High Voltage is present in this panel at the top of the Three Phase Input **even with the disconnect off**. If working on the panel, follow the safety protocol as described in Chapter 1.

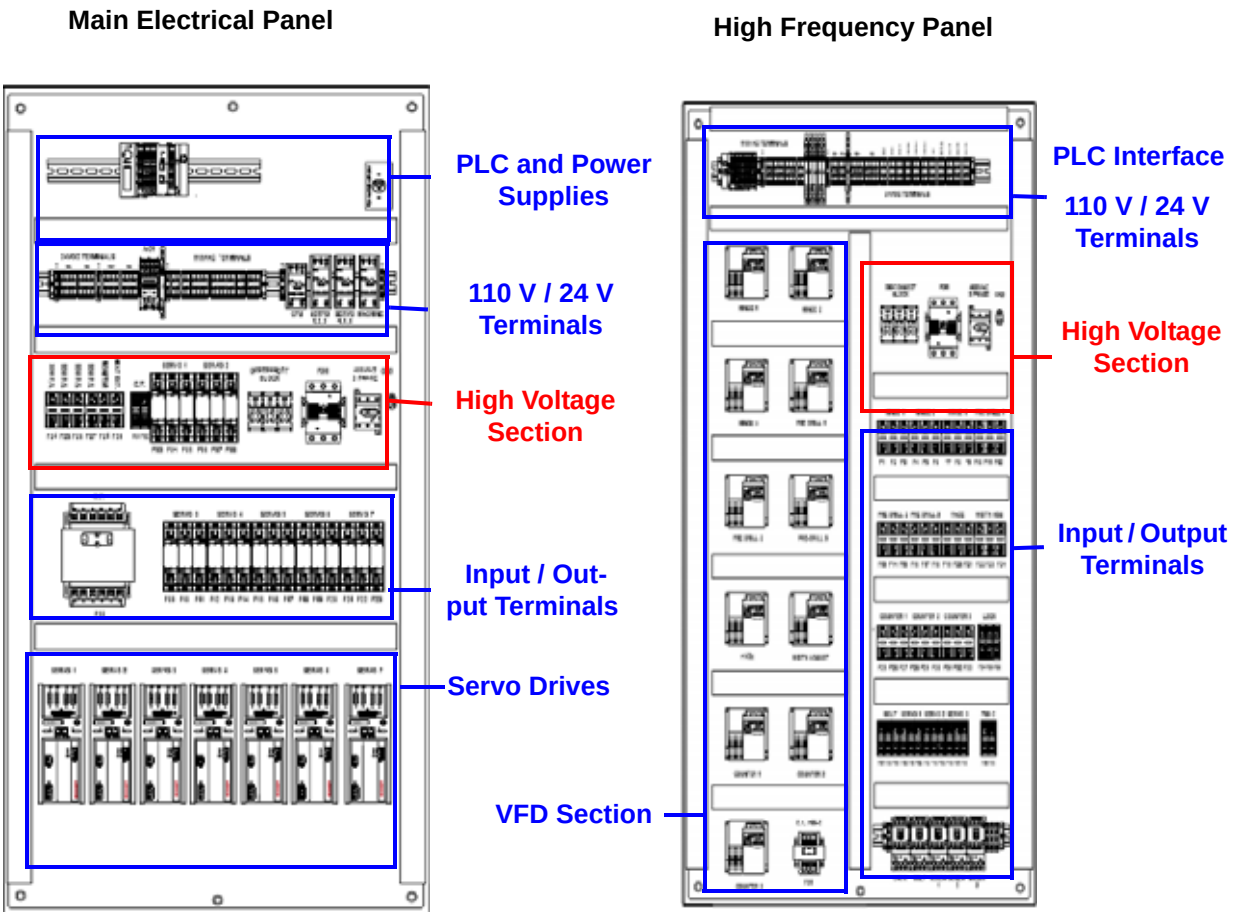


FIGURE2- 12. Overview of Main Electrical Panel and High Frequency Panel

Description of the Six Light Panel

The six lights on this panel indicate the status of the 994-X system.

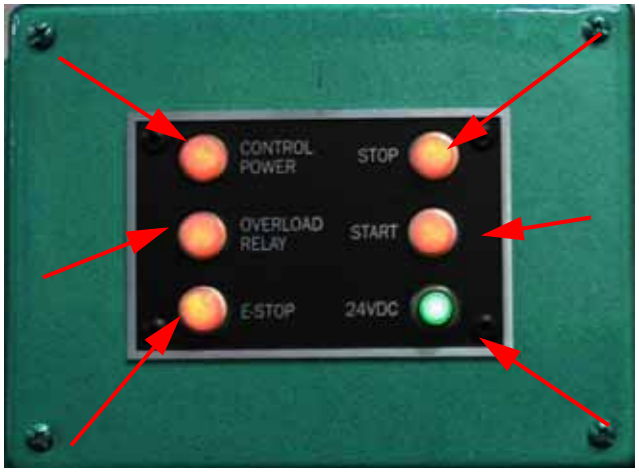
The Sequence that the lights activate is as follows:

1. Control Power
2. Overload Relay
3. E-Stop
4. Stop
5. Start
6. 24VDC

Control Power – light illuminates when the Control Transformer is pulled out and the power is working on secondary side-of transformer

Overload Relay – The overload circuit is working when light is on

E-Stop – The back gate is closed and Frame E-stop is not activated when this light is on.



Stop – This light will be on if Machine Stop button is deactivated.

Start – This light will be on once the Machine Start button is pressed and the ACR Relay is latched.

24VDC – light comes on once the ACR is latch and the 24VDC power Supply is working

About Sensors

On the 994-X, sensors provide input to the PLC as part of the automation of the door cutting process. It is important to keep the sensors cleaned and aligned to keep the door process running smoothly. There are two classifications of sensors on the 994-X------Photo Electronic and Inductive Proximity Sensor.

The **Photo Electronic Decor** uses light as a trigger.

- **Photo Eye Detectors** contain both emitter and receiver. If an object is within the Photo Eye's sensing field light from the emitter is reflected from the object back to the receiver. With *no object* is in front of the Photo Eye a constant 24VDC is sent to the PLC. If an object is sensed by the Photo Eye, 0VDC is sent to the PLC.
- As a result, any of the photo detectors output equals 0VDC when a door is sensed.

The **Proximity Sensor** detects metallic objects without touching them.

- An inductive proximity sensor consists of a coil and ferrite core arrangement, an oscillator and detector circuit, and a solid-state output. The ferrite core and oscillator create a field generating out the front of the sensor. When a metal object enters the field, a loss in amplitude occurs. The detector circuit recognizes the loss of amplitude and generates 0VDC to send to the PLC. When the metal object leaves the sensing area, the sensor to returns to 24VDC and sends it to the PLC.
- As a result, if a metal object is sensed, the output of the sensor equals 0VDC.

Refer to Figure 2- 13 on page 19 for some examples of Sensors:

FIGURE2- 13. Examples of Sensor

Quick Start

Power Up & Home

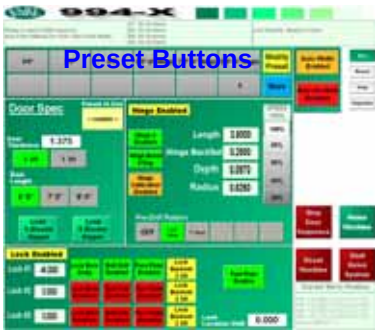
Ensure factory air is present at the machine and the 994-X main air supply valve is turned on.

Power up the 994-X. See “How to Power Up the 994-X” on page 2-22.

Home the 994-X. See “Home the 994-X” on page 2-23.

Use Main Screen

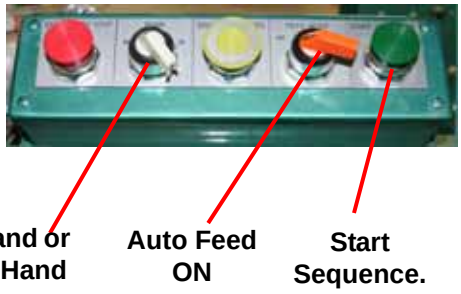
From the **Main Screen**, choose a **Preset** button to load door parameters or choose your own setup through the **Main Screen** selections. See “Main Screen” on page 2-27.



Door Setup

From the control bar on the middle front of the machine, turn the **Door** switch to **(RH)** Right Hand or **(LH)** Left Hand Door.

Turn the **Feed Mode** switch to **ON (**Auto Feed).



Load Door

Feed in a door from the Door Feeder.

Load Jamb

Insert a Jamb, pressing it firmly against the jamb stop.

Holding the jamb in place with hands in the proper position, press the **Jamb Clamp** foot pedal to activate the jamb clamps.

Caution: Read the Hand Placement and Warning Stickers on the Machine.

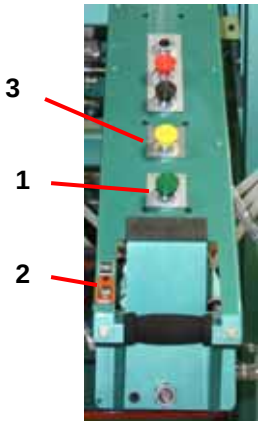
While loading the jamb, it is important to be mindful of the placement of your hands. If hands are in the wrong place when the jamb is being loaded, **the jamb clamp could crush hands.**

Press **Start Sequence** from the control bar to start the machining process. The front section will start to machine the hinge pocked on the jamb and door. The back section will machine the lock and lock plate.

Load the hinge on Six Shooter alignment plate with the hinge pin towards the top of the door and the counter sinks facing out. The alignment plate is magnetic and will hold the hinge in place

Caution: Be prepared for the front section routers to move into position and begin routing, as well as the back section routers, lock bore, and bolt drill.

Slide the Six Shooter over and position it into the H-Block using the Ryertex guides.



1. Press the **Start Sequence** button to move the Six Shooter into position and drop the screws. The six shooter will snap into place.
2. When fully seated, press the **Insert Screw** Button to attach the six screws
3. Press the **Reset** switch to raise the Six Shooter out of the hinge pocket and feed a set of six screws for the attachment of the next hinge.
4. Repeat steps 1-3 for each Hinge.
5. Return the Six Shooter to the park (starting) position. The machine will not run if this is not completed.
6. When finished with Hinges, unclamp the door and jamb by either pressing the **Unclamp** button on the Six Shooter or pressing the Jamb Clamp foot pedal.

To continue, repeat from the load door section in this quick start.

If completed, shut down the machine. See “How to Power Down the 994-X” on page 2-23 .

Powering Operations for the 994-X

This section describes how to power up and to power down the 994-X.

Powering up the system includes:

- Applying power to the entire system
- Starting the Control Circuit

Powering down the system includes:

- Shutting down the control power
- Removing power from the entire system

How to Power Up the 994-X

1. Ensure factory air is applied to machine and main air supply is turned on.
2. Check that all E-Stop buttons are out and safety gate door s are closed.

   Note: A pop-up is displayed on the user screen if an E-Stop is pressed. The pop-up will indicate which E-Stop has been activated
3. Make sure the electrical disconnect the electrical cabinet is turned to the ON position.
4. Switch the green **CONTROL TRANSFORMER** switch to the ON position. It should light up.
5. Push the green **START MACHINE** button to “boot up” the machine.

Note: Boot up may take 2 to 3 minutes.

6. All lights on the status light panel on the electrical box should be illuminated. See “Description of the Six Light Panel ” on page 2-18

   Note: If a status light does not turn on during the power up process, see “Troubleshooting with the Status Light Panel” on page 6-7 for assistance in identifying the issue.

Home the 994-X

The 994-X must go through a homing routine before any operations are performed. The homing routine sets a zero reference from which the 994-X measures its movement and cutting process.

If power is lost or the 994-X is re-set, the homing routine must be performed again to reset the zero reference.

Press the **Home** button on the **Main Screen** touch screen.

1. The machine will move to the home position at the in-feed end of the machine.
2. The machine will then move to about the middle of its travel.

The 994-X is now ready for work.

How to Power Down the 994-X

1. Select **Shut Down System** from the **Main Screen** to close operator interface program and shut down the operating system.

   Note: Make sure Windows is shutdown completely before turning off the machine. Hard drive or data may be damaged if not turned off in this order.

2. Switch the green **CONTROL TRANSFORMER** switch to the OFF position.
3. KVAL also recommends that you turn the disconnect switch on the electrical cabinet to OFF; this helps reduce possible damage resulting from power surges from electrical storms.

1

2

3

Emergency Shutdown and Recovery

There are emergency shutdown (E-Stop) switches located at key points around the machine.

Note: Depending on options of the machine, the E-Stop buttons may be located at various locations.

The E-Stop switches are to be used when the machine is out of control or is about to damage personnel or equipment.

When an E-Stop switch is activated, power to the machine is killed.

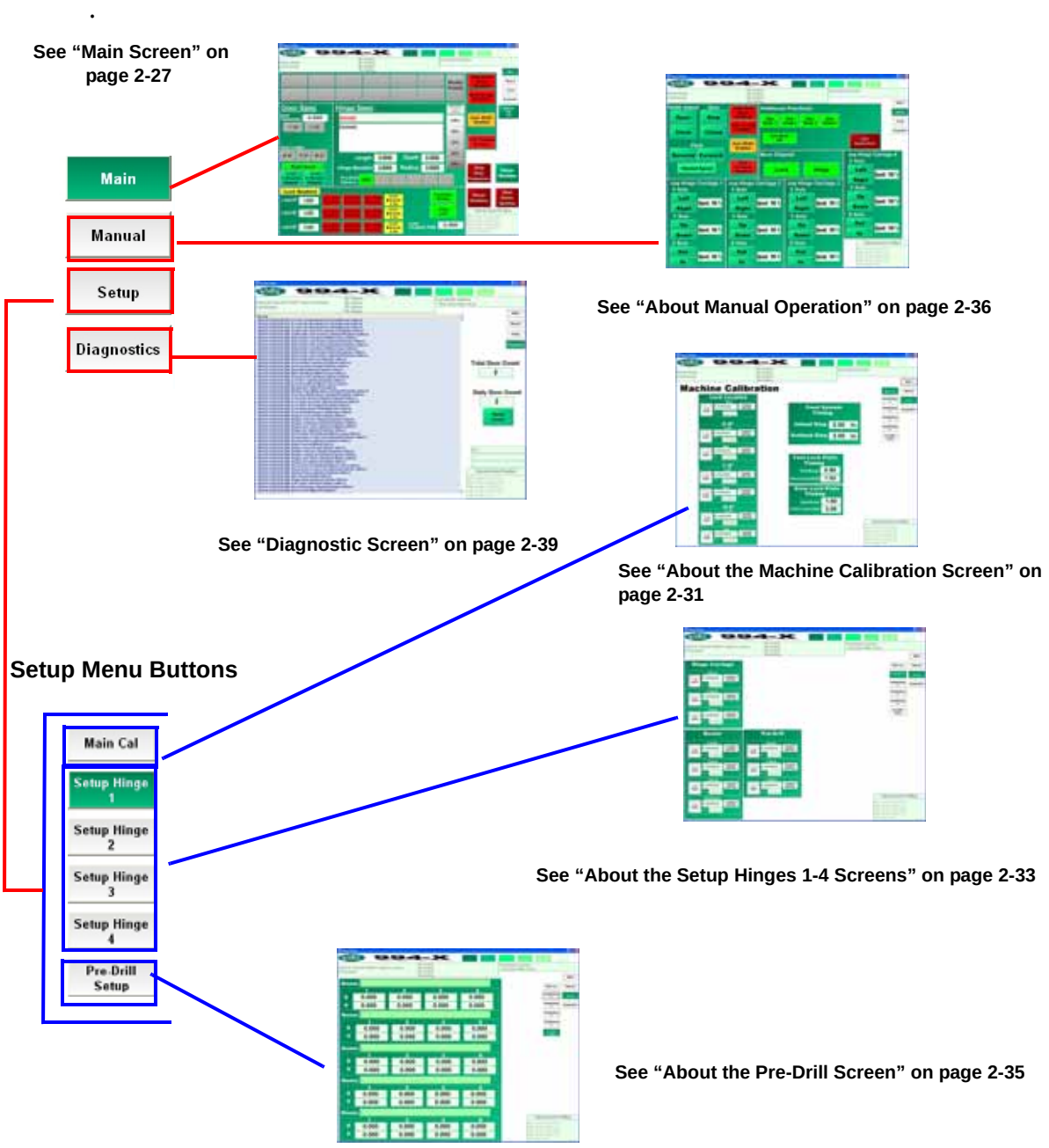
The machine responds, in the same way, if you press the STOP button on the operator's station.

Description of User Interface Screens

This section describes the user interface screens. The user interface allows the operator to use a touch screen to control the door cutting process, auto-run, manually run the door, store door profiles, and use diagnostics to help troubleshoot the 994-X.

Screen Selection Menu Map

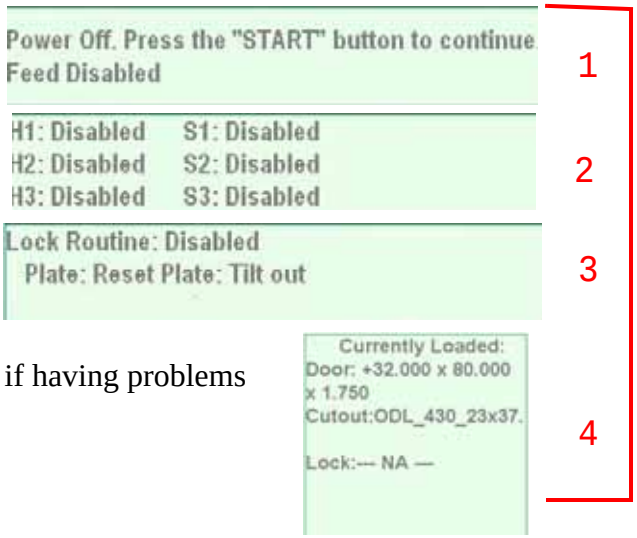
Below are the menu selections for the 994-X.


See “Main Screen” on page 2-27
Main
Manual
Setup
Diagnostics
See “About Manual Operation” on page 2-36
See “Diagnostic Screen” on page 2-39
See “About the Machine Calibration Screen” on page 2-31
Setup Menu Buttons
Main Cal
Setup Hinge 1
Setup Hinge 2
Setup Hinge 3
Setup Hinge 4
Pre-Drill Setup
See “About the Setup Hinges 1-4 Screens” on page 2-33
See “About the Pre-Drill Screen” on page 2-35

Machine Feed Back

At the top and at the bottom right hand corner of all user screens is status feedback information. The information generated is as follows:'

1. General Machine Status
2. Front Section Status
3. Back Section Status
4. Current Servo Positions



Note: Use this information to isolate issues if having problems with the machine.

Controlling Access to User Screens

The 994-X has the ability to lock out changes to certain parameters such a presets and calibrations.

Note: Locked out parameters may vary due to customer design wants.

To allow the operator to make changes to parameters, turn the **Set Up Lock** to the On position. When this key is in the Off position, the parameters are locked out. No changes to the parameters may be made in the off position.

The key may be taken out in the off position, to prevent any inadvertent changes to the cut parameters.

Main Screen

The Main Screen is also the startup screen for the 994-X. From this screen, all the basic user interface controls are available to run a door.

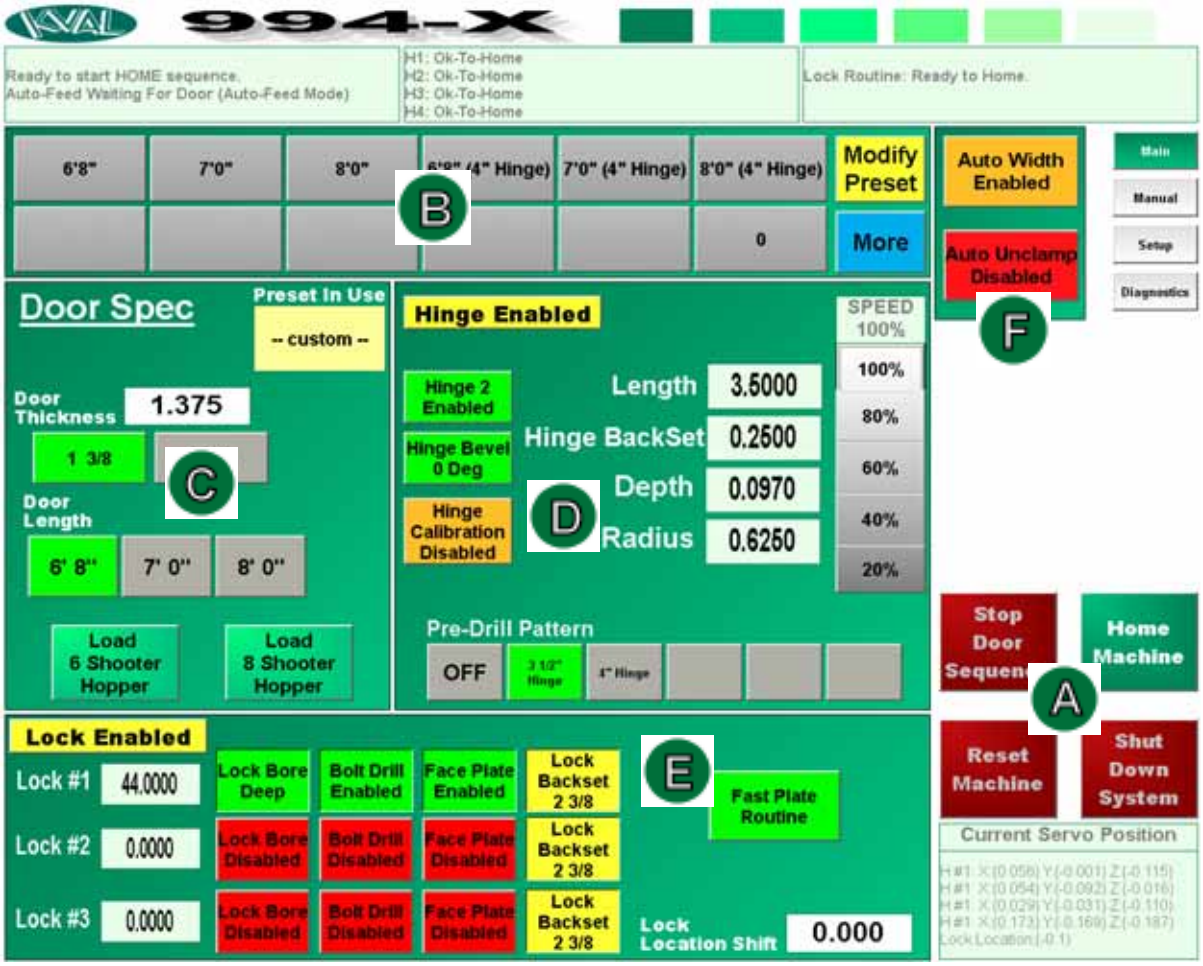


FIGURE2- 14. Main Screen

A Home Machine Button

This button starts the home sequence on the machine, which slowly scans to find a physical reference point on the frame. When this point is found, the position is stored and then used to calculate the location of all moves after this.

The home sequence must be performed every time the machine is powered up or reset.

Reset Machine Button

If a fault occurs that cannot be cleared, press the **Reset Machine** button. This button will reset the machine to the start position *before* homing.

Press **Home Machine** after Reset Machine

Stop Door Sequence Button

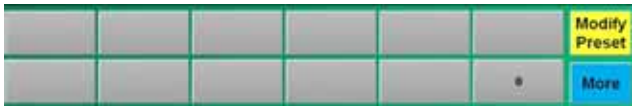
This button stops the door in the process.

Shut Down System Button

This button shuts down the computer. Use this button as part of the shutdown process.See “How to Power Down the 994-X” on page 2-23

B Preset Selection Button Group

Pressing a preset button, calls one of twelve presets stored in memory. Pressing the **Modify Preset** button allows the operator to store the active **Main Screen** parameters.



After pressing the **Modify Preset** button:

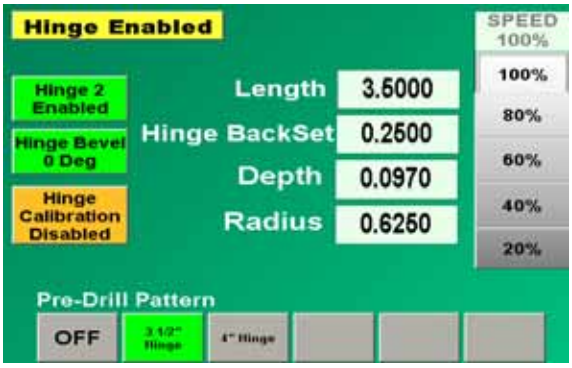
1. Select one of the buttons in which to save the parameters
2. Name it to an appropriate label.
3. Select the save button to save to memory.

C Door Spec Group

Set the parameters for the door in the **Door Spec** group. The settings include:

- Shows the preset setting that is running
- Can enter a door thickness.
- Choice between two door thickness settings.
- Can Select Door Length
- Can load 6 Shooter or 8 Shooter (Option)

D Hinge Spec Group



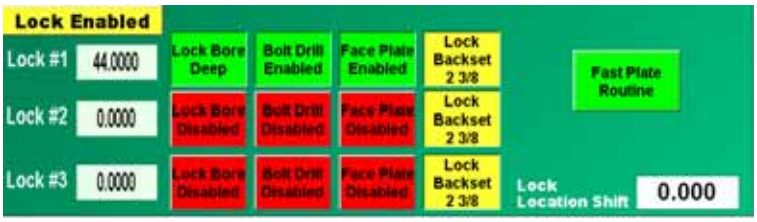
Set the parameters for the hinges in the **Hinge Spec** group. The settings includes:

- Router speed adjustment (real time adjust)
- The choice of pre-drill patterns
- Can enable or disable hinges.
- Can select and change hinge parameters
- Can disable and enable hinge calibrations.

You can select **Pre-Drill** buttons to down load pre-drill parameters or turn off this function. To set Pre-Drill parameters, see “About the Pre-Drill Screen” on page 2-35 .

This section also contains the file list window, which displays files that are available to use.

E Back Section Group



Set the lock parameters, in the **Back Section** group. The settings include lock specifications for 3 lock settings, the ability to *enable and disable* lock bore, bolt drill, and face plate routing. Fast Plate can be enabled or disabled

Lock Backset (Option) shows the backset for each head.

Auto Enable and Disable Buttons

From these buttons you can toggle auto functions on or off.

Auto Feed (Option): Press **Auto Feed** to toggle the auto feed on or off. In auto mode, the feed system will bring in and clamp a door, wait for processing to complete, then feed the door to out.

Feed Through (Option): Press **Feed Through** to toggle the feed through on or off. In feed through mode, the door will pass through the machine without processing.

Auto Width: Press **Auto Width** to toggle the auto width on or off. In auto width mode, the machine will automatically set the width adjust system for optimum clamping.

Auto Unclamping: Press **Auto Unclamping** to toggle auto Unclamping on or off. The auto unclamp button sets the machine to automatically unclamp the door after machining is completed.

About the Setup Screens

Select the **Setup** Button on the Main Screen to open access to the:

- **Main Cal (Machine Calibration)** screen
- **Setup Hinge 1-4** screens
- **Pre-Drill Setup** screen

About the Machine Calibration Screen

The **Main Cal** button leads to the **Machine Calibration** screen. In this screen, you can perform machine calibration of the lock location and lock bore location on the back section, change machine timing, and speeds, and position the jamb shelf on the front section.

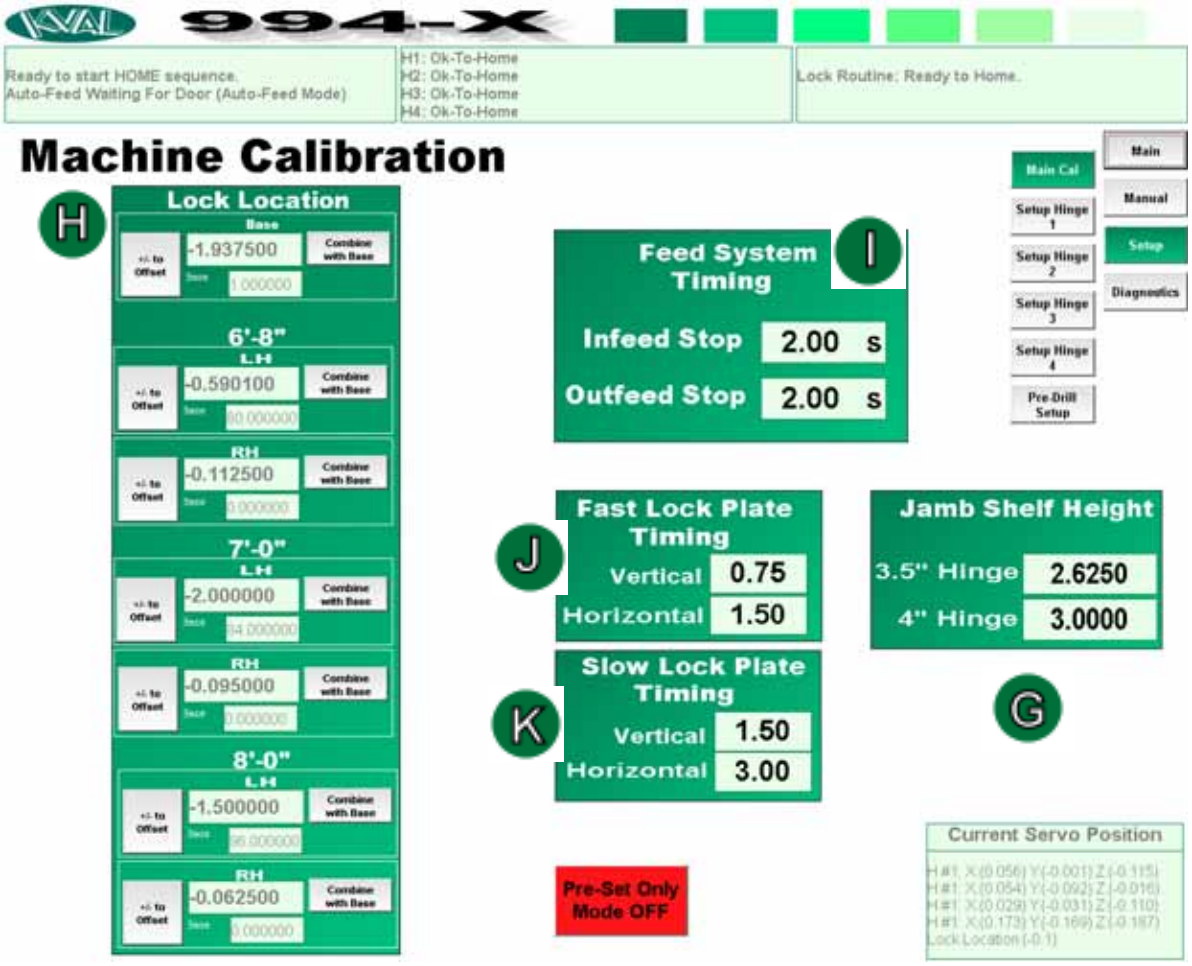
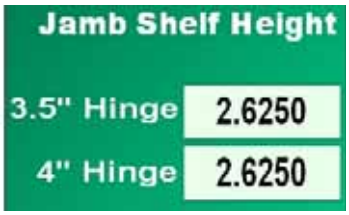


FIGURE2- 15. Setup Menu

G

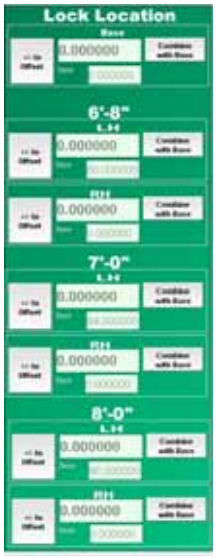
Jamb Shelf Height Adjustments



Adjusts the jamb shelf height. This parameter is usually set once.

H

Lock Location Adjustments



Adjusts the lock location in the back section. Adjustments can be made for right hand and left hand doors for 6'8", 7'0"and 8'0" door sizes.

Lock Location:

Choose the desired size door (**6'8'',7'0'',8'0'') or Base.**

Base: Moves the lock location for both left hand and right hand doors. This is the original reference.
LH: Moves the lock location for left hand doors only.
RH: Moves the lock location for right hand doors only.

I

Feed System Timing Adjustments

Infeed Stop: This is distance the clamped door is located after the “after-infeed eye”.
Out feed Stop: This is the distance the clamped door is located after the “before-out feed eye.

J

Fast Lock Plate Timing

Vertical: The amount of time, in seconds, to give the vertical movement of the lock plate when in “Fast Plate” mode.
Horizontal: The amount of time, in seconds, to give the horizontal movement of the lock plate when in “Fast Plate” mode.

K

Slow Lock Plate Timing

Vertical: The amount of time in seconds to give the vertical movement of the lock plate when in "Slow Plate" mode.
Horizontal: The amount of time in seconds to give the horizontal movement of the lock plate when in "Slow Plate" mode.

About the Setup Hinges 1-4 Screens

From these screens, you can adjust the parameters of each head. Refer to Figure 2- 1 on page 2 for head locations.

- **Setup Hinge 1**
- **Setup Hinge 2**
- **Setup Hinge 3**
- **Setup Hinge 4**

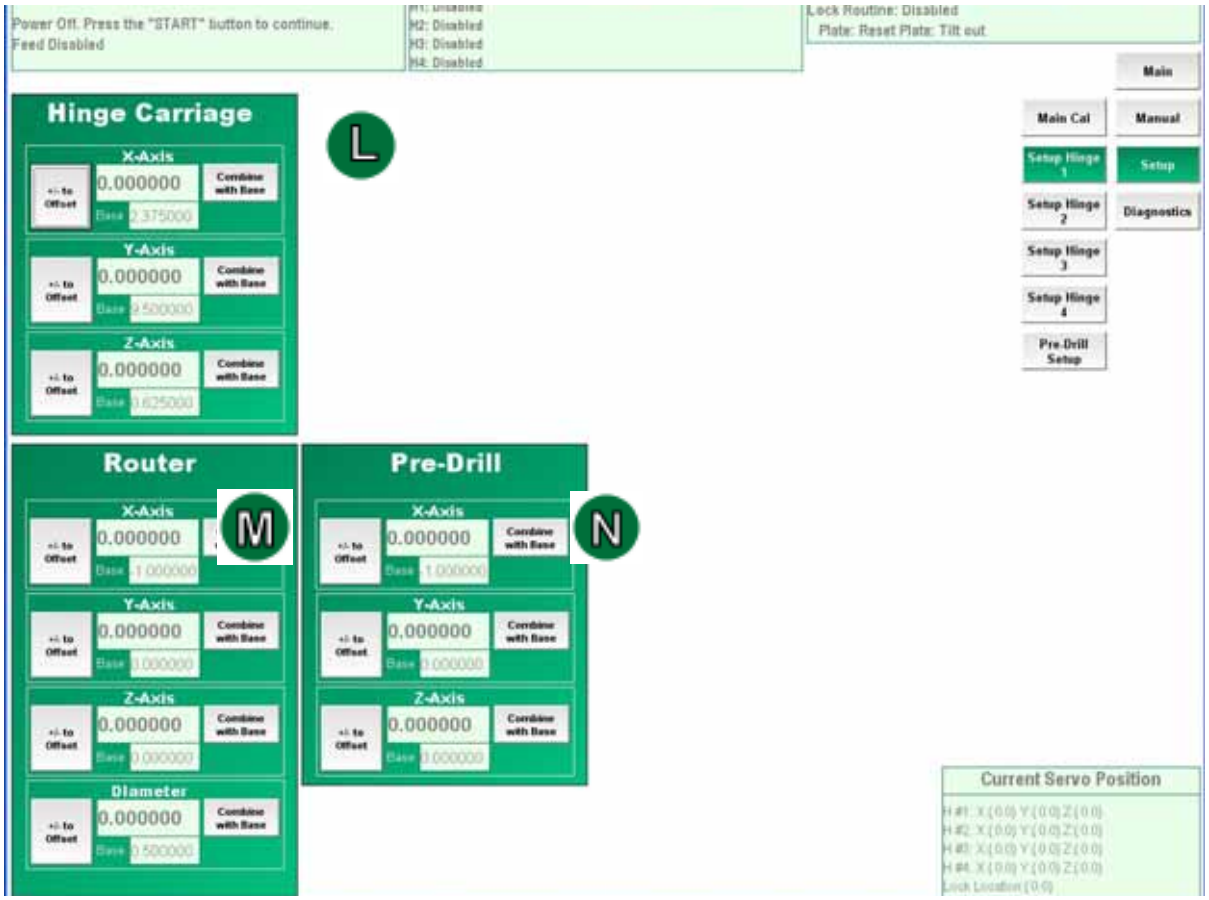


FIGURE2- 16. Hinge Setup Menu (1 of 3)

Hinge Carriage Adjustments

Hinge Carriage Location: This calibration number adjusts the position of the hinge carriage in the X,Y,and Z direction.

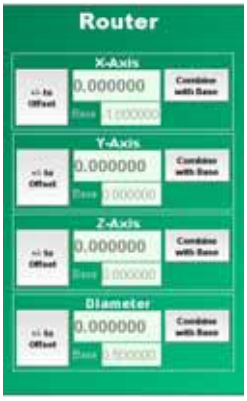
Pre-Drill Adjustments

Pre-Drill: These adjustments move the point-to-point drill in the X, Y, and Z direction.

Router Adjustments

These adjustments move routers in the X, Y, and Z direction. This also adjusts the radius of the router cut.

Use this to compensate for minor changes in tooling during calibration.



About the Pre-Drill Screen

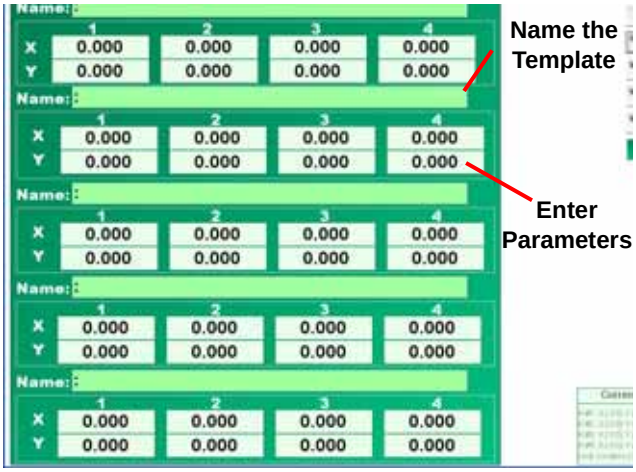
From this screen, you can adjust and store up to five pre-drill screw patterns in memory.
.

The X and Y valves are referenced off the bottom of the hinge on the door to the center of the hinge

The jamb pre-drill holes are equal to the mirror image of the parameters entered. This allows for less time entering data and keeps precision drilling patterns.

The number '0' entered in both X and Y are equal to no drill.

See the figure below. Imagine a graph over the Hinge. The X and Y values in the graph are entered in the Sample Template screen shot below.



Note: Never enter a negative number in the 'Y' parameter. The pre-drill will try to drill off the door into the Delrin.

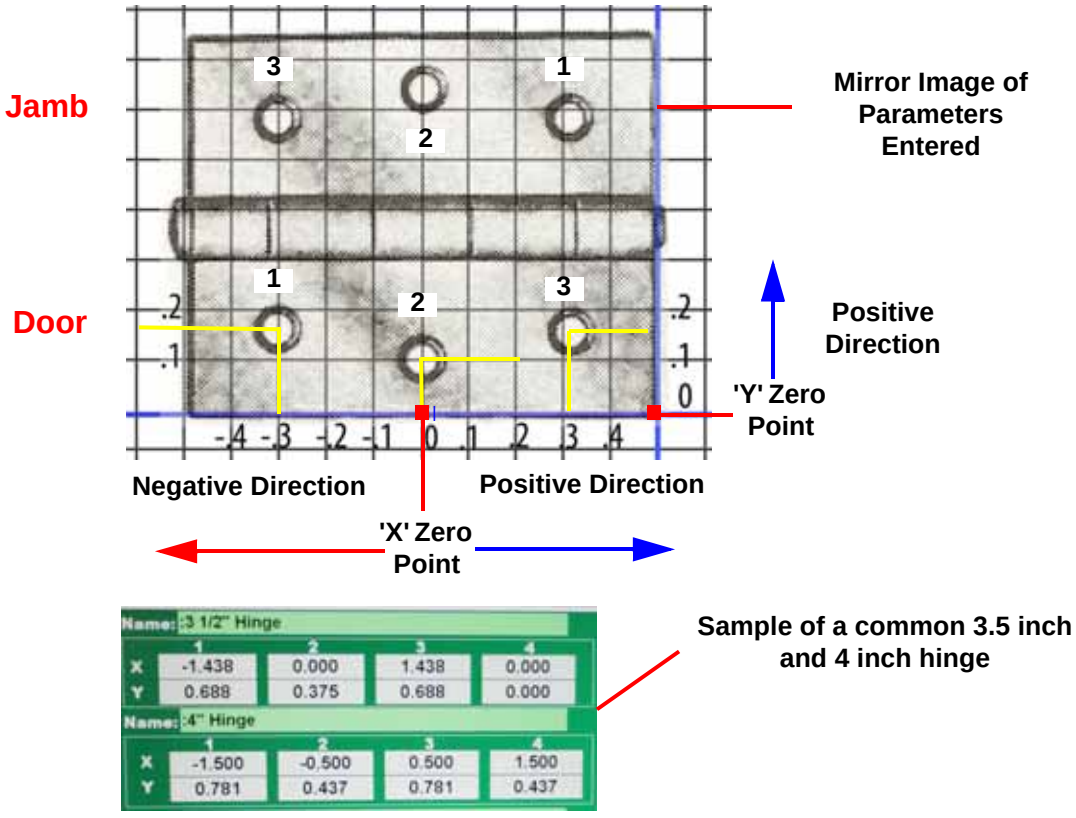


FIGURE2- 17. Pre-Drill Screen Description

About Manual Operation

From this screen, you can control certain functions of the machine in manual mode. This screen is mainly used in troubleshooting, checking cut specifications, and maintenance.

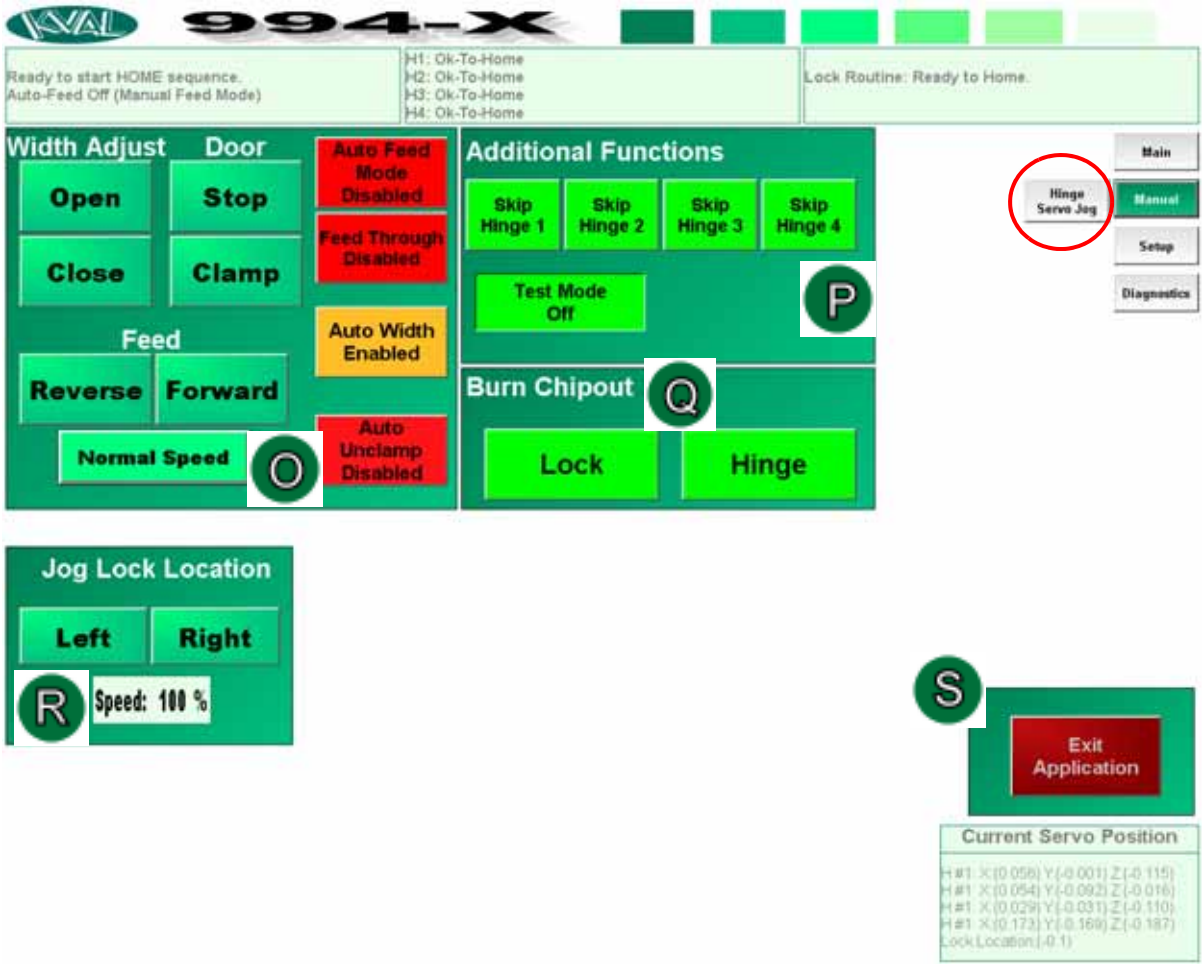
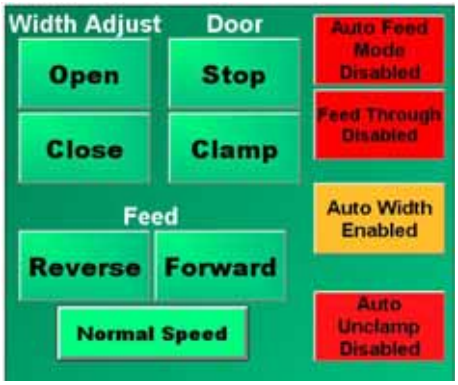


FIGURE2- 18. **Manual Operation Screen**

FIGURE2- 19. **Jog Carriage screen**

O Width Adjust Operation



Width Adjust:

- **Open:** Press and *hold* the **Open** button to open the width adjust carriage. To stop the carriage, release the button. The carriage will also stop if the positive travel limit eye is activated.
- **Close:** Press and *hold* the **Close** button to close the width adjust carriage. To stop the carriage, release the button. The carriage will also stop if the negative travel limit eye is activated.

Door:

- **Stop:** Press the **Stop** button to extend or retract the appropriate door stop.
- **Clamp:** Press **Clamp** to activate the cylinders that clamp the door.

Feed:

- **Reverse:** Press and hold the **Reverse** button reverse the feed of the door. To stop the feed, release the button.
- **Forward:** Press and hold the **Forward** button to move the door feed forward. To stop the feed, release the button.
- **Normal Speed:** Press and hold the **Normal Speed** button to slow speed. To return to previous speed, release the button.

Toggle Buttons:

The buttons to the right toggle auto functions on or off. For descriptions of these buttons, see “Auto Enable and Disable Buttons” on page 2-30 .

P Additional Functions Operation

Skip Hinge 1-4: Select to Skip the hinge route and drill functions any hinge.

Test Mode: Select to toggle the Test Mode on or off.

Test Mode runs the hinge cycle, but does not extend the tools. This is primarily used to verify a new template is correct and the hinge carriage will not bump into the H-Block or other assemblies.

Q Burn Out Chip Operation

Use this menu if a new Chipout Block is installed on the lock section or the hinge section. Press the appropriate button to start the burn sequence. a new hole will be slowly drilled. the process will automatically stop when finished.

R Jog Lock Location

Use this menu to move the lock location on the back section.

S Reset Button

Press the **Exit Application** button to close the user screen and return to the Windows desktop. This can be used if the operator needs to use a different Windows application.

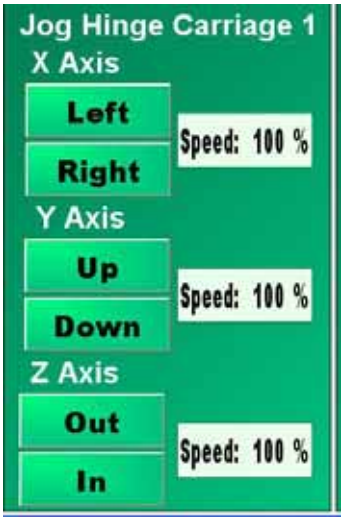
T Jog Hinge Location Carriage 1-4

X Axis Left or Right: Press and hold buttons to jog the hinge carriage location left or right. To *stop*, release the button

Y Axis Up or Down: Press and hold buttons to jog the hinge carriage location up or down. To *stop*, release the button

Z Axis Out or in: Press and hold buttons to jog the hinge carriage location in or out. To *stop*, release the button

Speed: Select the white box and enter the speed of the carriage. The range is 1% to 100%. Use the number pad to enter the desired speed and press OK when finished.



Diagnostic Screen

The Diagnostic screen displays all the tasks the 994-X performs. This screen can help with trouble shooting by associating the error code to machine sections or functions. The top line will have the most current routine that is running. If the machine issue can not be resolved, call KVAL Inc. (1-800-553-5825). Have any error code that is displayed, ready to give the KVAL representative. This will aid in troubleshooting and shorten down time.

The Diagnostic screen keeps track of the all the doors processed on the machine. The quantity is displayed in the **Total Door Count** box.

To keep track of daily production, the quantity of doors produced in a day is displayed in the **Daily Door Count** box. This count can be reset with the **Reset Count** button.

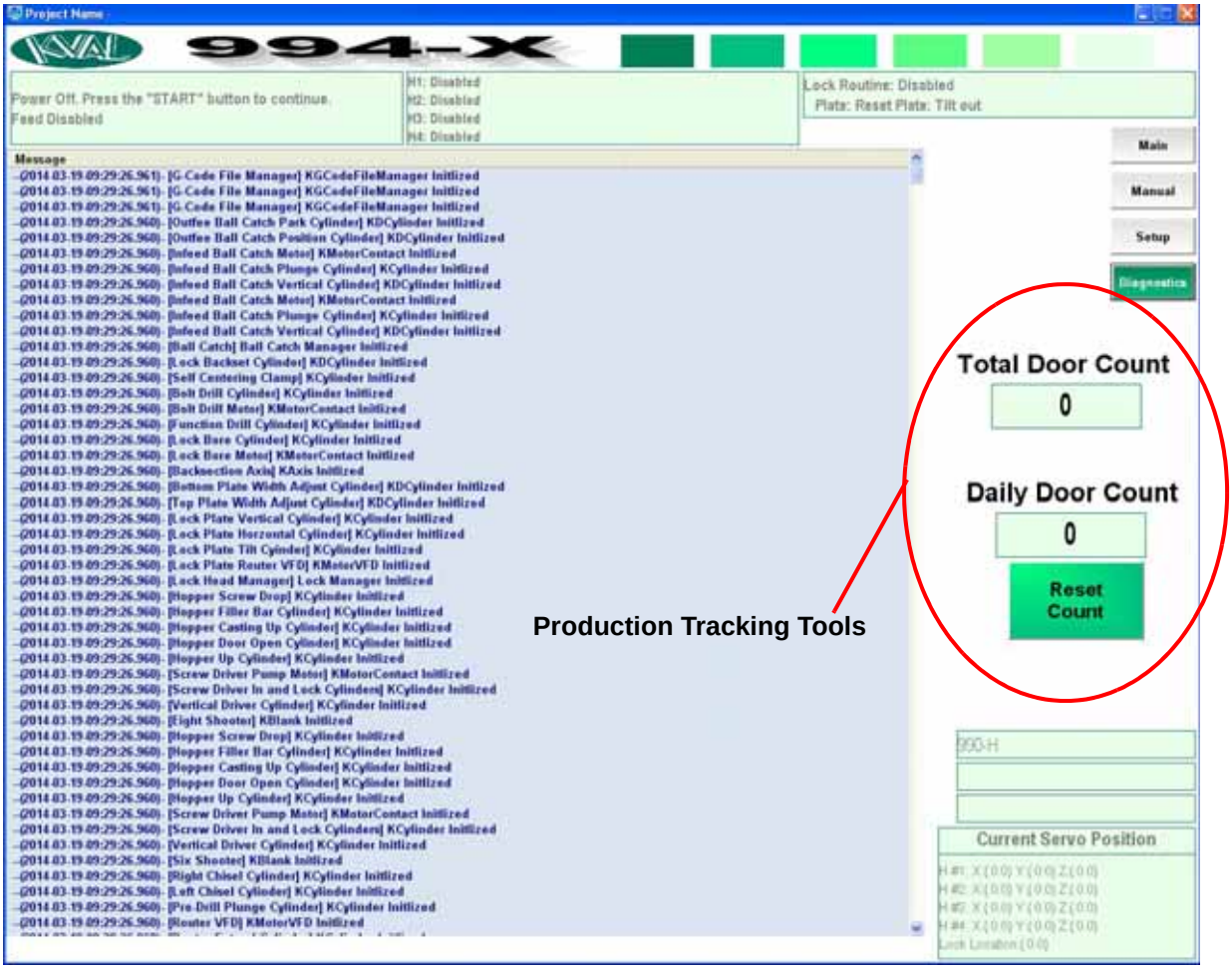


FIGURE2- 20. **Diagnostic Screen**

CHAPTER 3 Calibration of 994-X

This chapter describes the steps to calibrate the 994-X, Door Pre-Hanging Machine

Chapter 3 at a Glance

About Calibration 3-2
- Before you Calibrate 3-2
- Flow Chart of Calibration 3-3

About the KVAL Calibration Routine 3-4
- Calibration Slot Drilling Specifications 3-5

Run the Calibration Routine 3-6
- Select Calibration 3-6
- Select Door Parameters 3-6
- Load the Door and Start the Cut 3-6
- About Motion of Servo Motors: X,Y, Z, and W 3-7

Check Specifications of the Front Section 3-8
- General Instructions to Adjust Parameters 3-8
- Step 1: Hinge Carriage Calibration 3-9
- Step 2: Router Calibration 3-11
- Step 3: Pre-Drill Calibration 3-12

Calibration of the Back Section 3-14
- Lock Location Calibration 3-15
- Fast and Slow Lock Plate Timing 3-16

About Calibration

Calibration is all about the confidence in the end results of your manufacturing process. Calibration assures you that your cut parameters are accurate and within the specified limits.

In troubleshooting, calibration can be an essential step in solving the issue. The goal is to start with a known reference to confirm and isolate issues that can cause improper cuts.

The KVAL 994-X has a built in Calibration routine to cut a horizontal slot with known parameters. The routine allows you to make the cut, measure, observe any anomalies, and help isolate to the component that causes the problem.

This chapter describes how to use the Calibration routine.

Before you Calibrate

Before you start calibration, check for the following common issues and ask yourself these questions:

1. Is the loaded setup correct for the current cut?
2. Are the machine stops set up correctly?
3. When did the problem first start? (during a run, at start up?)
4. When was the last calibration?
5. Is the door square, straight, and bevel correct?
6. Ensure the door is tight against all H-Blocks
7. Ensure the door is clamped up tight against the reveal.
8. Is the router or pre-drill depth correct? (Use a Router Bit Depth Gauge (PN: 432C) to check depth.)
9. Check tools for wear.
10. Check back side of th H-Blocks for sawdust build-up, which may affect depth.

Note: KVAL recommends that a test door is machined first and checked for specifications before production is started. If any cut parameters are inaccurate, use the embedded calibration routine as a step to verify the validity of the test setup.

Flow Chart of Calibration

The flow chart below illustrates the steps in performing a calibration on the 994-X.

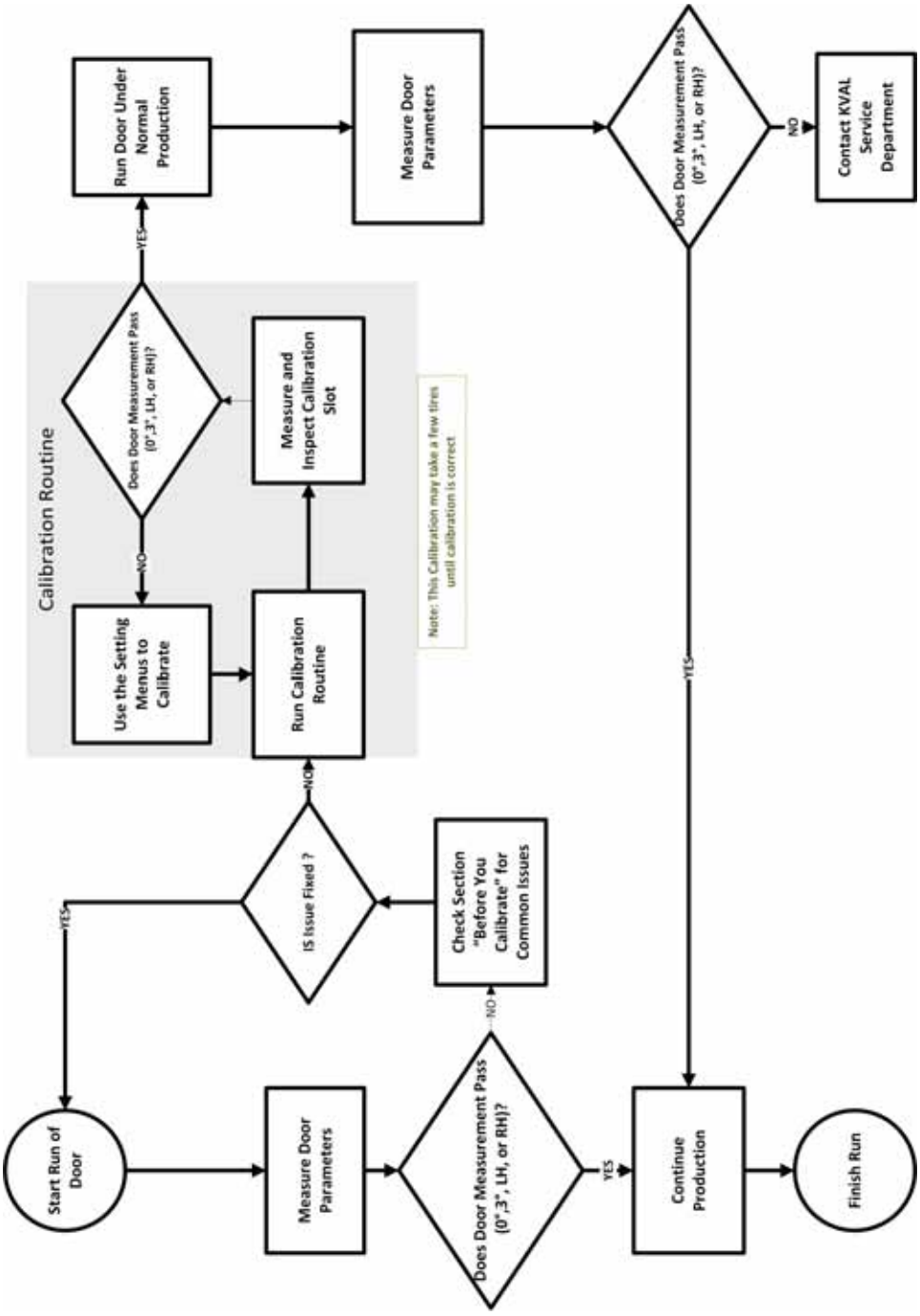


FIGURE 3- 1. Calibration Process Flowchart

About the KVAL Calibration Routine

The calibration routine creates a reference cut to check settings against a “known good” source. The routine is used to verify the front section. It routes a horizontal slot and drills a center hole at precise specifications. Using these specifications as a reference, you can inspect the pattern and the specifications of the slot for inaccuracies. The front end assemblies that use the calibration routine are as follows:

1. Hinge Carriage
2. Router
3. Pre-Drill

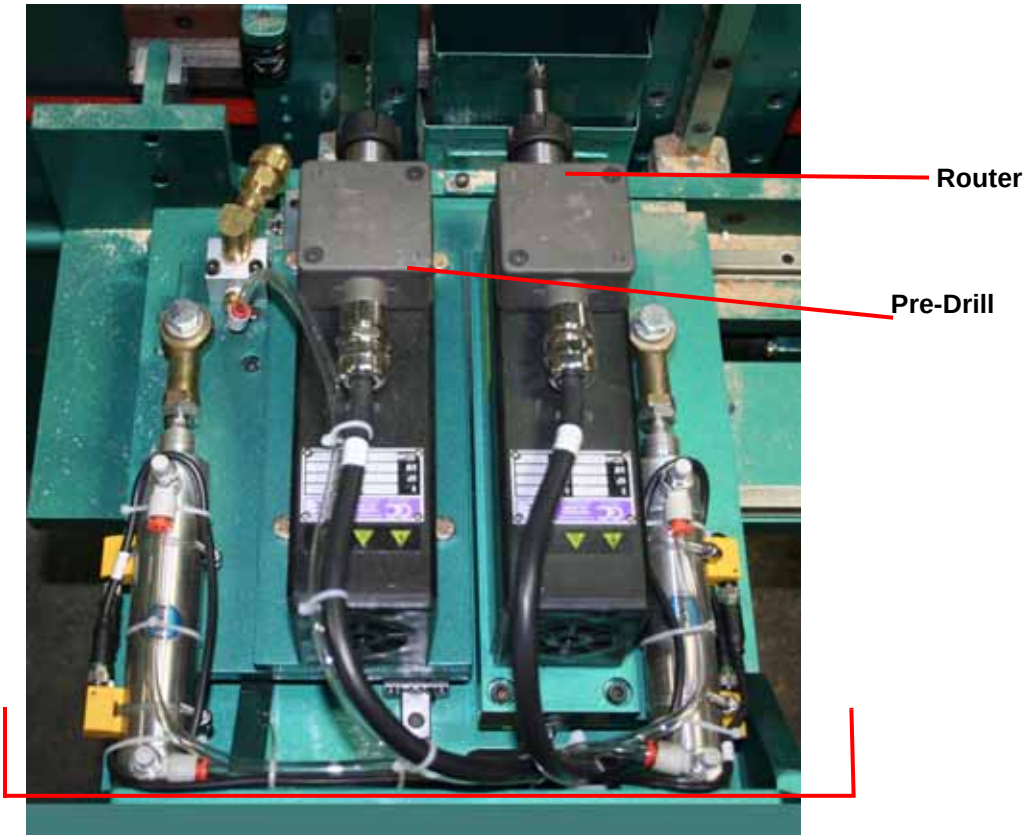


FIGURE 3- 2. **Location of Assemblies**

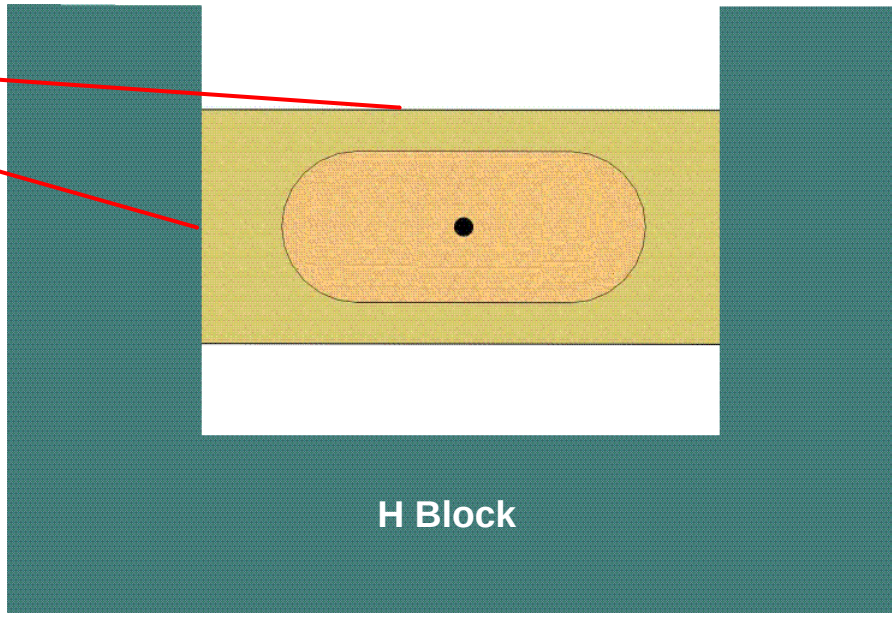
Calibration Slot Drilling Specifications

The calibration routine will route the following slot with the dimensions and positioning below

Slot Position:

Center of Door Edge

Center Between H Block



Pilot Hole:

Position = Center of Slot

Width= Diameter of Drill

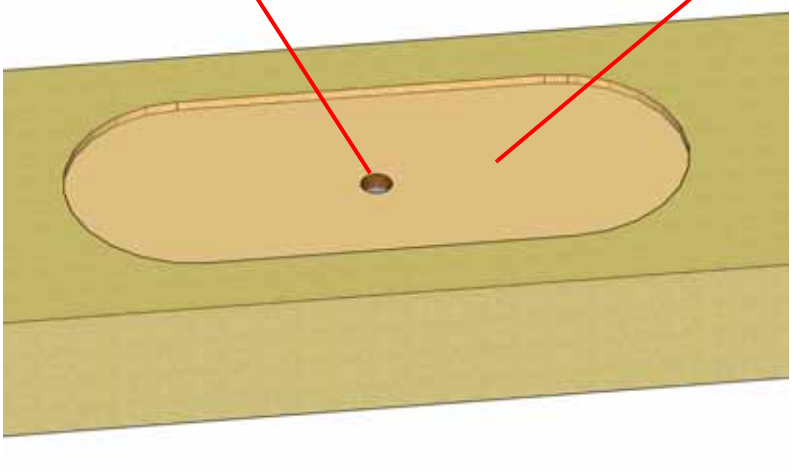
Depth = 0.250"

Router Slot:

Length = 1.000" + Diameter of the Router

Width = Diameter of Router

Depth = The Hinge Depth Setting from the Operators Station

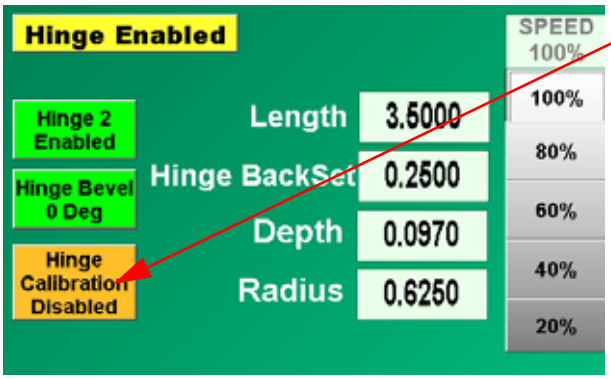


Run the Calibration Routine

After checking for common errors, start the calibration cut process.

Select Calibration

From the Main Screen, choose **Calibration**.



Enable **Calibration** from the Menu list on the Hinge Spec Group

NOTE: If Calibration is not on the list, contact KVAL service. KVAL service can remotely download the program if LAN and WEB enabled.

FIGURE 3- 3. Calibration Routine Selection

Select Door Parameters

From the Door section of the User Interface, choose the following below.

1. Choose Door Height (Thickness).
2. Choose Door Length.
3. Disable three of the hinges leaving one hinge enabled.

Load the Door and Start the Cut

1. Load the test door into the in-feed of the 994-X.
2. Verify the setup and check for machine is safe to run.
3. Press the **Start** button, to begin the process.

About Motion of Servo Motors: X,Y, Z, and W

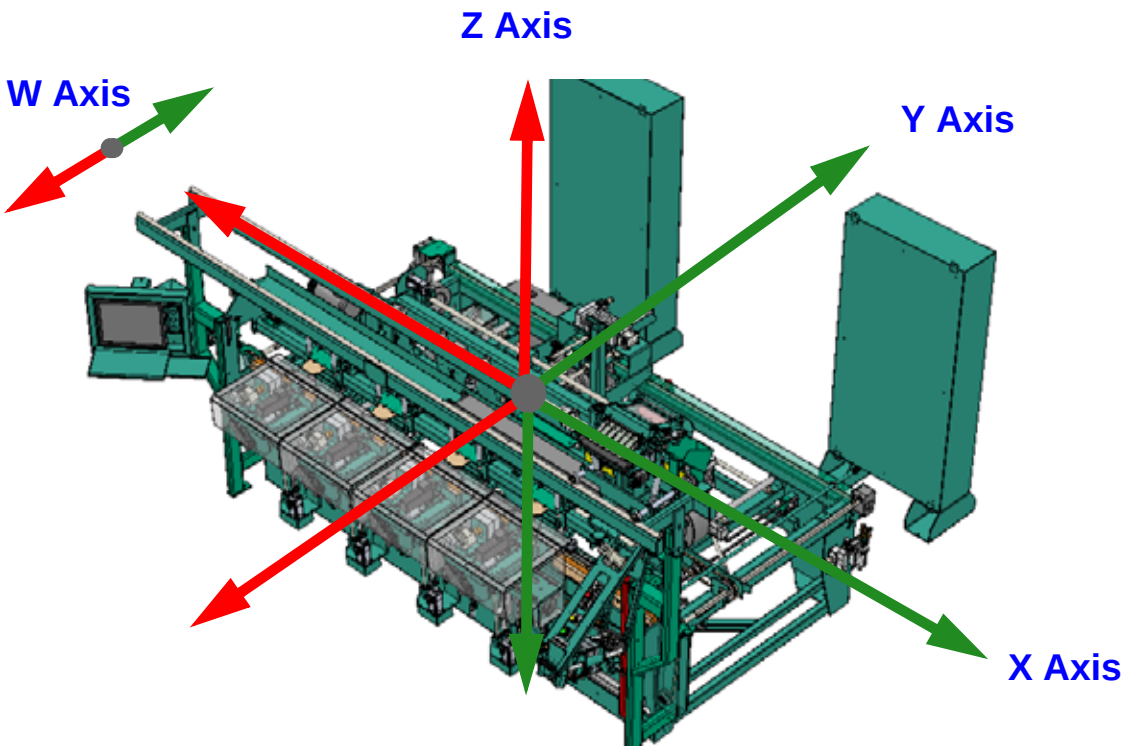
The figure below shows the motion of the 'X' axis, 'Y' axis, 'Z' axis. and 'W' axis. Use the figure below as a reference when calibrating the machine. The reverse direction equates to a negative number and the forward direction equates to a positive number when entering data into the calibration menus. Use this information as a guide to help input the directional data in the calibration routines.

W Servo Motor
Red = Close
Green= Open
(width adjust)

X Servo Motor
Red = Reverse
Green= Forward

Z Servo Motor
Red = Up
Green= Down

Y Servo Motor
Red = Close
Green= Open



Red = Reverse Direction

Green = Forward Direction

Check Specifications of the Front Section

Follow these steps in this section to verify the result of the cut and, if necessary, adjust the machine.

General Instructions to Adjust Parameters

From the Main Screen select **Setup---Setup Hinge 1. 2,** or **3** to get to the Hinge Setup screens.See “About the Setup Hinges 1-4 Screens” on page 2-33 for further detail.

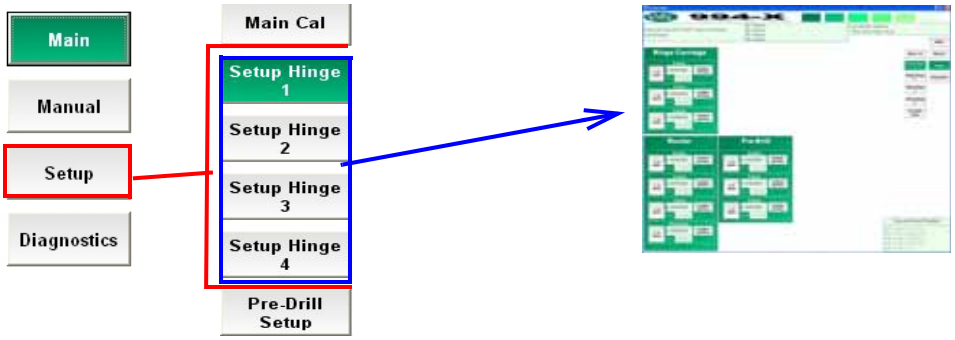


FIGURE 3- 4. Path to Setup Hinge Screens

Located in the setup screens are adjustment menus. In these menus you can add negative or positive adjustments to move a cutting assembly to the desired position. Enter the data in the white box below the parameter. The **Base** display box keeps a running total of data entered to help keep track of the changes. The **Combine with Base** button stores data in memory and should be used at first to set a reference and at final to store data. See “About Motion of Servo Motors: X,Y, Z, and W” on page 3-7 for information on direction of servo motors.

Title: of assembly to adjust
Parameter: to adjust (X,Y,and or Z axis.)
Offset: Select this button to add or subtract the measured number entered.
Base: Keeps a Running Total of measured numbers entered.
Hinge Carriage
X-Axis
0.000000
+/- to Offset
Combine with Base
Base 2.500000
Enter: Type in measured data
Combine Base: Select this button at start of adjustment to set a reference and end of adjustment to store it.

FIGURE 3- 5. Sample of an Adjustment Menu

Note: KVAL suggests to follow the steps in the order below.

Step 1 Verify and Adjust the Hinge Carriage

Step 2 Verify and Adjust the Router Calibration

Step 3 Verify and Adjust the Pre-Drill Calibration

Step 1: Hinge Carriage Calibration

Adjusting the X Axis

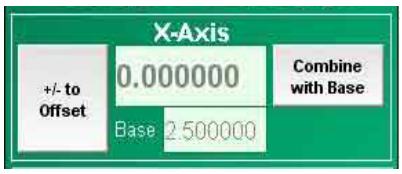
1. Run the Calibration Routine. See “Run the Calibration Routine” on page 3-6. Use the H Block as a reference to determine the horizontal center of the calibration slot. Figure 3- 6 on page 3-10, shows an example of left and right *off center* locations.

2. Measure the amount of material left between the H-block and the slot on both sides of the slot (a and b).

3. Calculate the difference between “a “and “b” and then divide by two. See Figure 3-6 on page 3-10.

4. Next, what way does the slot need to move? To move to the left, enter a positive number. To move to the right enter a negative number.

5. Locate the appropriate Menu in the Setup interface screens



6. If there is a number in the box under X-Axis, select the **Combine with Base** button to set a reference.

7. Once this number is added to the base, double select the box that has 0.000. A calculator will be displayed. Enter the offset in this box.

8. If it needs to go in the negative direction, select the negative symbol.

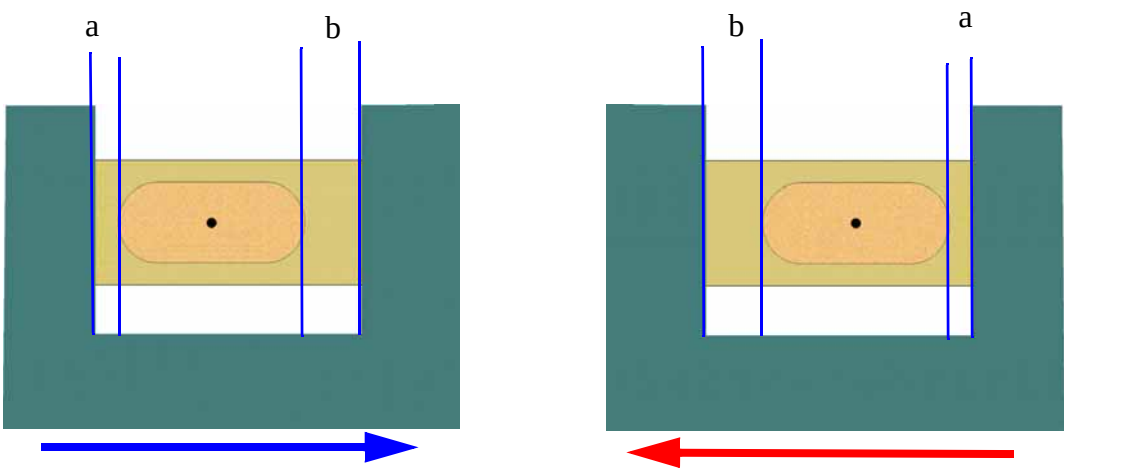
9. Select the check mark to confirm this number and exit to go back to the Setup screen.

10. Exit out of the Setup screen and rerun the Calibration test.

11. Re-measure the slot.

12. If slot is not centered, repeat the steps above until the slot is centered.

13. After centering is achieved, select **Combine with Base** to store the corrections.



Enter a **positive** number to move the carriage **left**

Enter a **negative** number to move to the carriage **right**

FIGURE 3- 6. **Samples of X Axis Adjustments**

Adjusting the Y Axis

1. Run the Calibration Routine. See “Run the Calibration Routine” on page 3-6. Use the H Block as a reference to determine the vertical center of the calibration slot. Figure 3- 7 on page 3-11, shows an example of high and low *“off centralizations*.
2. Measure the amount of material left between the ***Actual*** Door Width and the slot on both sides of the slot (a and b).
3. Calculate the difference between “a “and “b” and then divide by two. Refer to the example located below.
4. Next, what way does the slot need to move? To move up, enter a positive number. To move down enter a negative number
5. Locate the appropriate Menu in the Setup interface screens.

6. If there is a number in the box under Y-Axis, select the **Combine with Base** button to set a reference.
7. Once this number is added to the base, double select the box that has 0.000. A calculator will be displayed. Enter the offset in this box.
8. Select the check mark to confirm this number and exit to go back to the Setup screen.
9. Exit out of the Setup screen and rerun the Calibration test.
10. Re-measure the parameters of slot.

11. If slot is not centered, repeat the steps above until the slot is centered.

12. After centering is achieved, select **Combine with Base** to store the corrections.

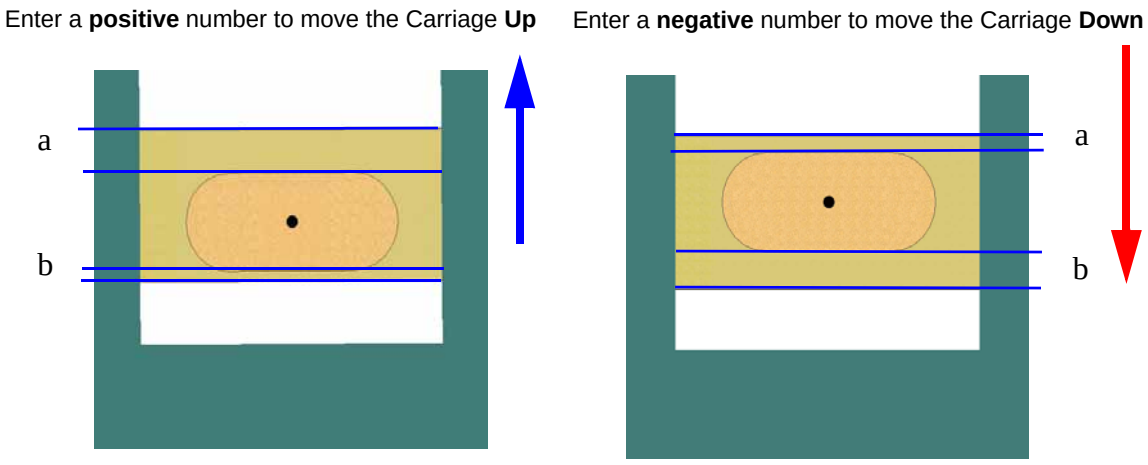


FIGURE 3- 7. Adjustments for the Y Axis

Adjusting the Z Axis

1. Run the Calibration Routine. See “Run the Calibration Routine” on page 3-6.

2. Measure the depths of the Router and Pre-Drill.

3. If depths are off, go to the Setup screen and select the appropriate Z menu

4. If the depth is too deep, enter a negative number of the difference of the measured and the desired depth.

5. If the depth is too shallow, enter a positive number of the difference of the measured and the desired depth.

6. Rerun tests until the correct depth is achieved.

Step 2: Router Calibration

Once the Hinge Carriage is calibrated to the center, verify the Router.

- The depth of the router should = Hinge Depth Setting from the Operators Station.
- The length of the router should =1.000" + the diameter of the bit.
- The width should = the diameter of the bit.
- The slot should be centered in the H-block and center on the thickness of the door.

Adjusting the Router:

1. Run the Calibration Routine. See “Run the Calibration Routine” on page 3-6.

2. Check, measure, and calculate specifications of Router cut.

3. To set a new reference, go to the calibration menu and select **Combine with Base.**

4. Enter calculations.

X: If the Router cut position is to the right-enter positive number. If cut position is to the left -enter a negative number

Y: If the Router cut position is high-enter negative number. If cut position is low-enter a positive number

Z: If the Router cut depth is too deep enter a negative number. If cut is shallow -enter a positive number

Diameter: The diameter menu allows adjustment compensate for discrepancies to the actual size of the router bit. If the diameter is not correct, it will affect the X,Y and Z parameters.

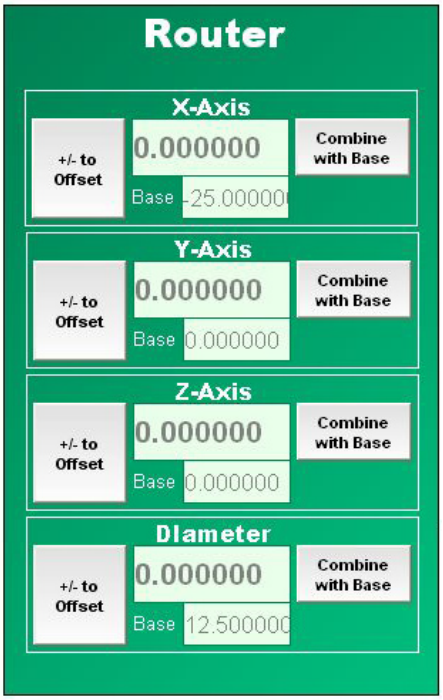


FIGURE 3- 8. **Router Calibration Menu**

5. Repeat until cut is centered.

6. Select the **Combine with Base** button to finish.

7. Repeat until cut is centered.

8. Click “Combine with Base” to finish.

Step 3: Pre-Drill Calibration

Verify the Pre-Drill

- The depth of the pre-drill should be 0.250 “ deep.
- The hole should be centered in the H-block and center on the thickness of the door

Adjusting the Pre-Drill

1. Run the Calibration Routine. See “Run the Calibration Routine” on page 3-6.

2. Check, measure, and calculate specifications of Pre-Drill cut.

3. To set a new reference, go to the calibration menu and select **Combine with Base**.

4. Enter calculations.

X: If Pre Drill hole position is to the right-enter positive number. If hole position is to the left -enter a negative number

Y: If Pre-Drill Hole position is high-enter negative number. If hole position is too low-enter a positive number

Z: If the Pre-Drill hole is too deep enter a negative number. If hole is too shallow enough -enter a positive number

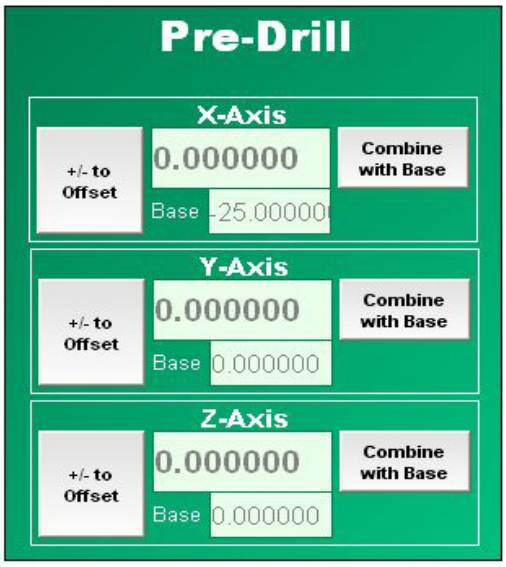


FIGURE 3- 9. Pre-Drill Router Calibration Menu

5. Repeat until hole is centered.

6. Select **Combine with Base** to finish.

Calibration of the Back Section

For the 994-X, there are two screens available to calibrate the back section.

From the **Main Screen** select **Setup**-->**Main Cal** to get to the Machine Calibration screen to access:

- Lock Location Calibration
- Lock Bore Location

From the **Main Screen** select **Setup**-->**Lock Plate Setup** to get to the Lock Plate Setup screen to access:

- Lock Carriage
- Router

:t

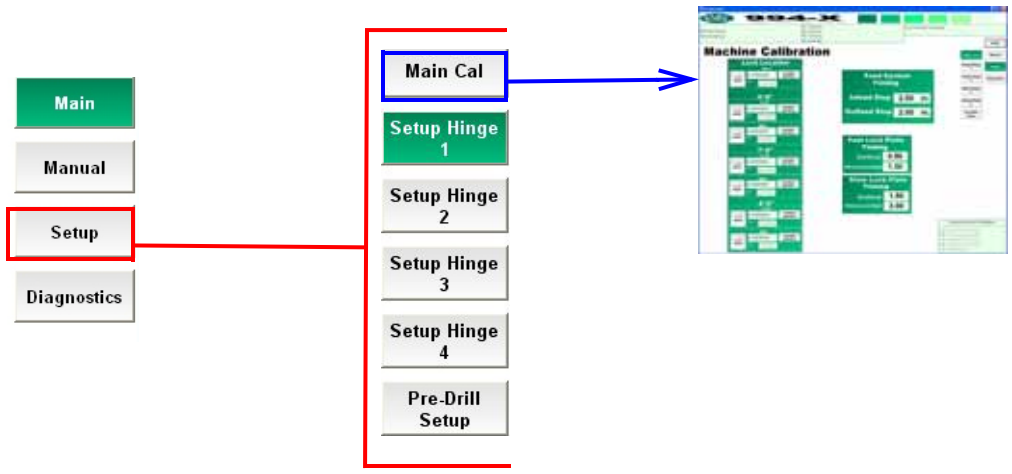


FIGURE 3- 10. Path to Calibration screen Back Section

Lock Location Calibration

To start, run a known good lock cut at a standard location on a Right Hand or Left Hand door.

Once the lock cut is completed, check the distance from the top of the door to the center of the lock.

Note the measurement value and compare to specification

If the lock location is correct, there is no need to perform this process, If it is not correct, follow the instructions in See “Adjusting Lock Location” below.

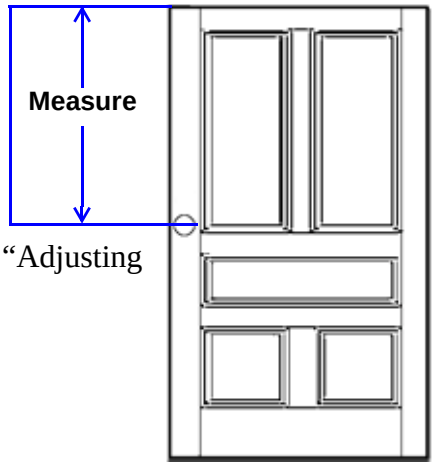
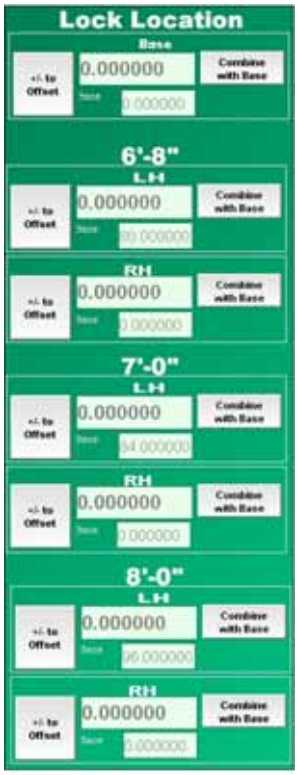


FIGURE 3- 11. **Reference Door Lock**

Adjusting Lock Location

1. Select the size door (**6'8''-7'0''-8'0'') or Base.**
2. Select Right Hand or Left Hand depending on the door run through process.
3. Under Base, select the **Combine with Base** button.
4. Enter a positive number to move the lock towards the bottom of the door (left) or a negative number to move the lock towards the top of the door (right).
5. Re-run the lock cut.
6. Measure again and repeat steps 3 to 4 until the center of the lock is at the desired cut location.
7. Once the completed with calibration, select the **Combine with Base** button to store the data.
8. Exit Main Calibration Screen.



Fast and Slow Lock Plate Timing

Adjust **Fast Lock Plate Timing** under normal operating (No Extend Time), the router time can be adjusted to match the flow controls on the machine. Before adjusting these times, make sure the flow controls are set properly.

Note: Before adjusting the Slow Lock Plate Timing, make sure the Fast Plate Routine is set properly adjusted.

If the settings are in **Extend Time,** adjust the **Slow Lock Plate Timing.**

FIGURE 4. **Fast and Slow Lock Plate Timing Menu**

Vertical:

If the vertical time is not making it up or down, before the horizontal move starts, enter a larger number. This number is in seconds. If there is a delay before the horizontal moves, enter a smaller number in this box. Continue entering numbers until timing is matched.

Horizontal:

If the Horizontal time is not making it left or right, before the vertical move starts, enter a larger number. This number is in seconds. If there is a delay before the vertical moves, enter a smaller number in this box. Continue entering numbers until timing is matched.

CHAPTER 4 System IT Administration

This chapter describes the KVAL 994-X controller. The controller is an on board computer that supplies the user interface and controls the operation of the machine. With the controller, KVAL can remotely help troubleshoot your machine.

Chapter 4 at a Glance

System IT Administration----------4-2
About the 994-X Computer----------4-2
Connections on the PLC----------4-2
Backing up the Computer----------4-3
About Remote Connection to KVAL Service----------4-3

System IT Administration

For optimum support, the 994-X requires internet access. With internet access, KVAL Service Support will be able to access your machine through your company's Intranet and help solve any issues that may occur. Connection to the Intranet is achieved by interfacing with the 994-X controller. The location of the Intranet connection is identified in the figure below (RJ45 to Intranet.)

About the 994-X Computer

The 994-X uses a Beckhoff® CPU module as a PLC (Programmable Logic Controller.) In addition to the CPU and the chipset, the module also contains internal main memory. The computer has a removable Compact Flash card from which it boots.The controller uses a Windows 7® operating system with TwinCAT 2® automation software to create the PLC and Motion Control method.

Interface modules include:

- A smart power supply to connect to EtherCat® terminals. This supply contains a LCD to display system and user messages.
- A DVI/USB module to connect to the user interface.
- An Ethernet module to connect to the servo amplifiers.

Connections on the PLC

The CPU module is located in the upper left corner of the Electrical Panel. See "About the Electrical Panels" on page 2-17. The figure below shows an example of a common PLC. Refer th the electrical drawing for detailed information.

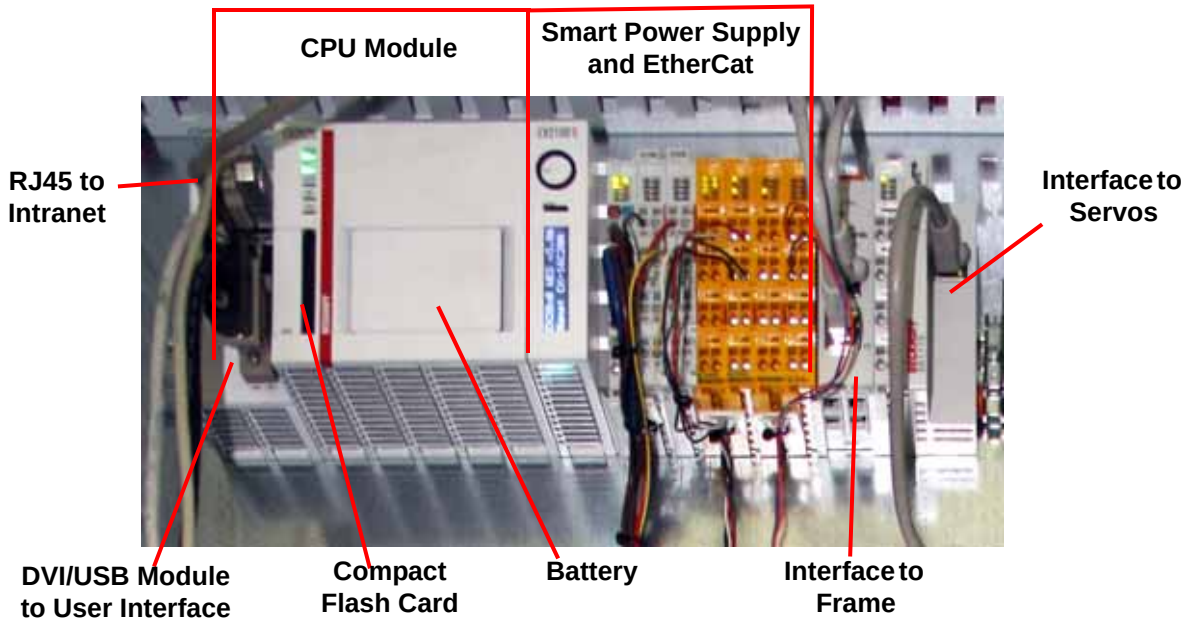


FIGURE4- 1. **Connections on the Controller**

Backing up the Computer

Backups keep your data archived in case of a rare system crash. Click the Back-Up Icon on the Desktop to back up your data. The data is stored in a backup folder in your Windows® directory. It is recommended to set up a back-up schedule to save your data on a regular occurrence.

The KVAL service team would be happy to help. If any questions occur, contact our service team at (800) 553-5825 or at www.kvalinc.com.

About Remote Connection to KVAL Service

Remote access is a powerful tool to help fix issues that occur with the 994-X machine. With the remote access, our KVAL service technician is able to observe your user screen in real time, read and adjust programming code. For 994-X access, a separate computer must have Beckhoff® software installed that is connected to the Intranet connection on the machine controller.

CHAPTER 5 Maintenance of the 994-X

This chapter describes preventative maintenance steps for *KVAL 994-X*. The content is geared to guide technicians to keep a regular maintenance schedule for your KVAL machine. Keeping your KVAL machine maintained is an important piece for successful operation of your door production process.

Chapter 5 at a Glance

Maintenance Schedule 5-2
- Daily 5-2
- Weekly 5-2
- Six Month Checkups 5-3

Lubrication Requirements 5-4
- Linear Bearings, Flange Bearing, and Pillow Blocks 5-4
- Gear Motor Lubrication Requirements 5-5
- Ball Screws 5-5
- Description of Air Input System 5-5
- Adjusting the Air Line Lubricator 5-6
- Priming the Air Line Lubricator 5-6

Lubrication Points on the 994-X 5-7
- Feed System 5-7

Replacing Bits 5-8
- Replacing Bits in the Front Section 5-8
- How to Access to Bit Assemblies 5-9
- Remove and Replace the Screwdriver Bits 5-11
- Back Section 5-12
- Changing the Bore Drill 5-13
- Changing the Bolt Drill 5-13
- Changing the Face Plate Router 5-14

Maintenance Schedule

KVAL recommends the following maintenance schedule to ensure that the machine operates properly. Refer to this section for steps to perform maintenance.

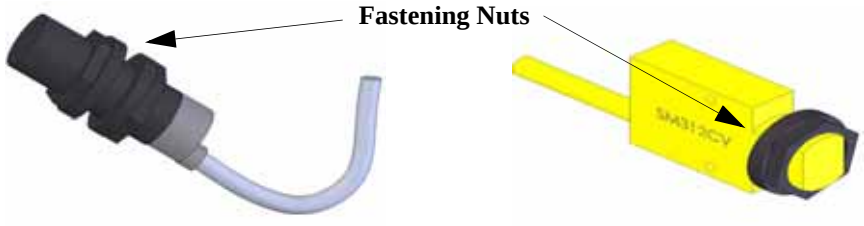
TABLE 5-1. Recommended Lubrication Schedule

Type of Assembly	Recommended Schedule	Recommended Lubrication Type
Linear Bearing	Every 250 Hours of Machine Operation	Dura-Lith Grease (KVAL P/N Lube EP-2)
Pillow Block Bearing		
Flange Block Bearing		
Ball Screw	Every 80 Hours of Machine Operation	
Air Line Lubricator	One drop of oil every 2 or 3 cycles Check the lines every week to two weeks	Either lubricant listed below is approved to use. • KVAL P/N SYSLUBG • Chevron AW Hydraulic Oil 32 • G-C lubricants light AW R&O • Mobile DTE 24 • Shell Tellus32 • Gulf Harmony 32
Gear Box	2000 Hours of Machine Operation or six months of operation	• AGMA #8 gear lube • MOBILUBE HD 80 W-90 • or equivalent

Daily

- Blow off dust from the entire machine.Wipe down the outside of the machine with a clean dry cloth
- .Check tooling for wear.
- Wipe off the photo eyes with a clean dry cloth, and check to ensure that all fastening nuts are snug.

CAUTION: Fastening nuts (as well as eyes) are plastic and threads can strip easily.

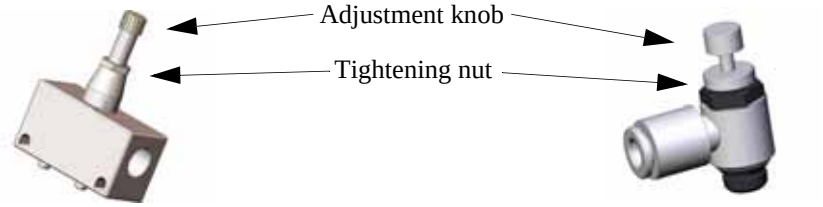


- Check the air pressure to make sure it is set at 80 psi to100 psi.
- Check the air filter water trap. Empty if full.

Weekly

- Check the machine for smooth motion through a complete door cycle.
- Clean linear bearings and the chrome shaft with a clean dry cloth, then lubricate.

• Inspect lock flow controls. Adjust if required.



• Check all air lines & electrical wiring for kinks or rubbing.

• Refill lubricator with an ISO 32 standard hydraulic oil (use KVAL part# SYS-LUBEG

Six Month Checkups

• Wash filter and lubricator bowls with soapy water.

• Grease all bearings and tighten all bolts. Access to some grease fittings is difficult and will require a special needle point grease tip (supplied with your system).

• Clean and lubricate all slides and cylinder rods with dry silicone spray.

• Tighten all bolts.

• Backup computer software. See “Backing up the Computer” on page 3-3.

• Lubricate linear bearings and chrome shafts with silicone

Lubrication Requirements

This section describes the parts of the machine that require periodic lubrication, and specifies the lubricants. In addition, it explains how to maintain the lubrication systems on the machine.

Linear Bearings, Flange Bearing, and Pillow Blocks

If the bearing is equipped with a grease fitting (Zerk Fitting), it should receive 1 Gram (one pump from grease gun) of Dura-Lith Grease (KVAL P/N Lube EP-2) every 250 hours of operation.

Note: Bearings without grease fittings have been pre-lubricated at the factory and do not require further lubrication.

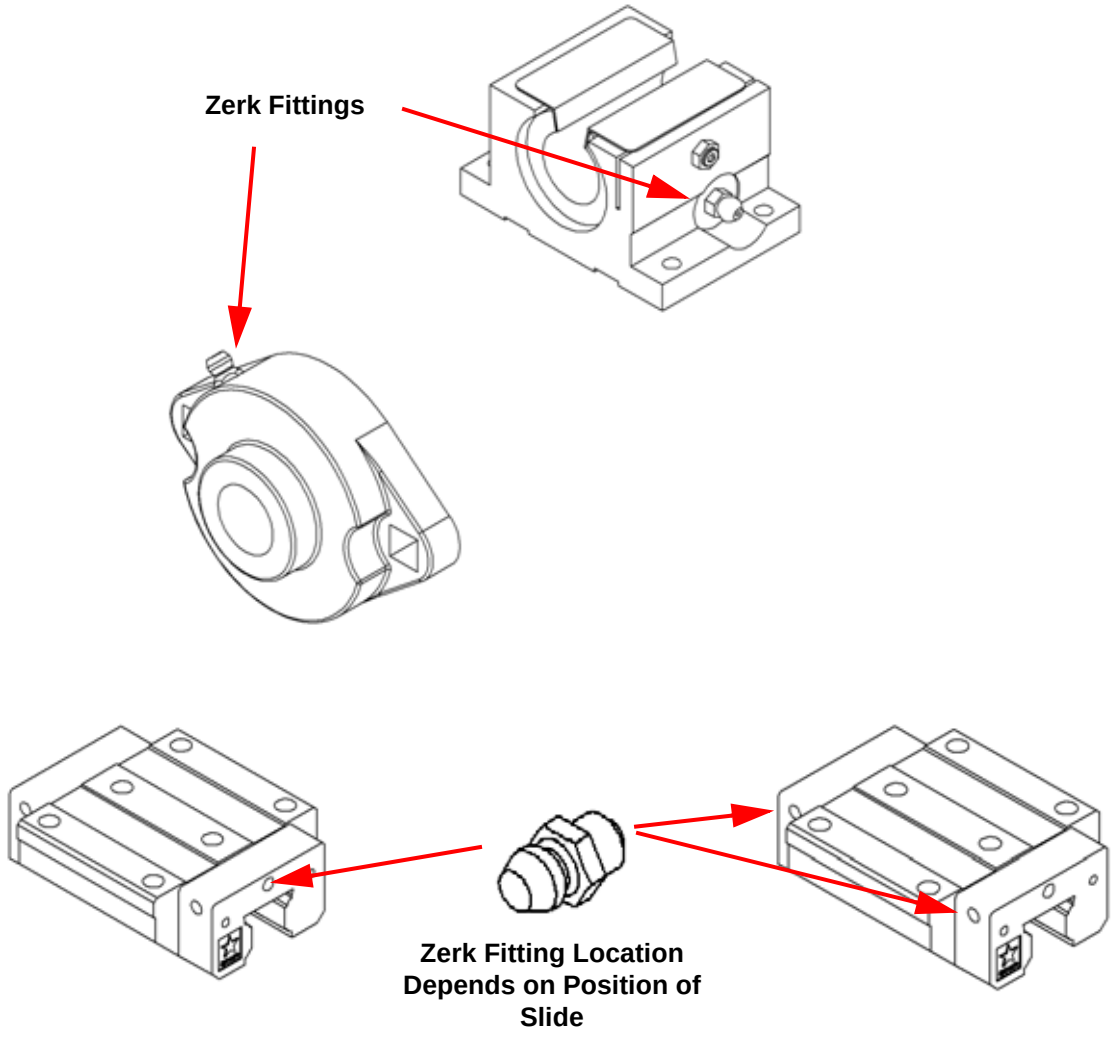


FIGURE 5-2. Zerk Fittings

Gear Motor Lubrication Requirements

Oil change is recommended after 2000 operation hours of operation. Use AGMA #8 gear lube or MOBILUBE HD 80 W-90 or equivalent.

Ball Screws

All ball screws should be lubricated Dura-Lith Grease (KVAL P/N Lube EP-2) for every 80 hours of operation. At each lubrication grease should be pumped into the fitting until clean grease comes out around the ball screw.

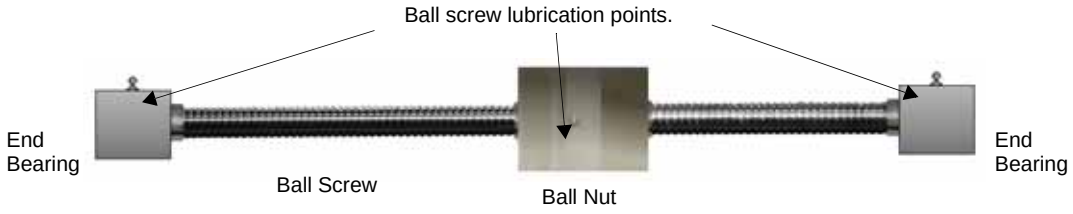


FIGURE 5-3. Example of a Typical Ball Screw

Important: Make sure to clean excess grease to avoid contact with feed belts, clamping areas, or the door.

Description of Air Input System

The air input system takes in shop air and supplies clean dry air (CDA) and lubricated air to the machine. The clean dry air is diverted to blow off nozzles. The lubricator, located after the CDA filters, delivers the lubricated air to valve banks and air cylinders.

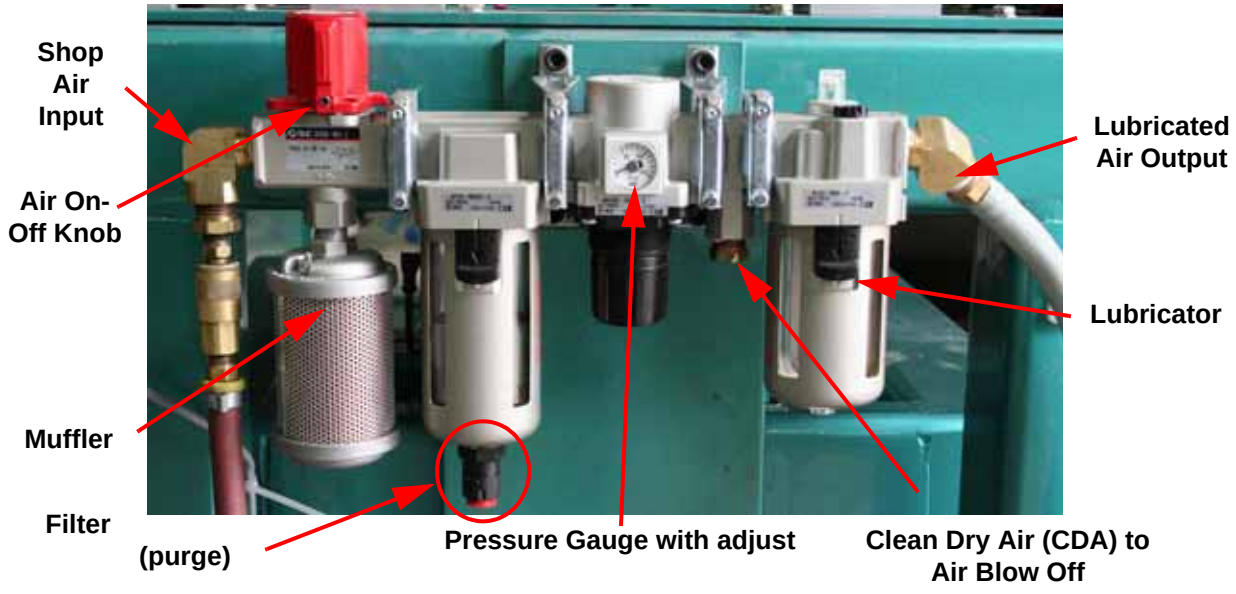


FIGURE 5-4. Typical Air Line Filter and Lubrication System

Adjusting the Air Line Lubricator

Using the knob on the top of the lubricator, adjust until one drop per every other cycle is used (as observed through sight glass.)

(Sight Glass). When the oiler has run dry, open the knob all the way until flow begins. Once you have a steady flow, tighten knob back down until you have one drop per every other cycle.

Drop will form at end of cane shaped tube visible inside glass.

Top of Lubricator

Priming the Air Line Lubricator

New and used machinery run out of oil from time to time. It is a good practice to check your machine lubricator to insure that it is putting the proper dose of oil in the air lines. Usually 1 drop of oil every other cycle is a good rule of thumb. The approved list of oil for lubricators is as follows:

- KVAL P/N SYSLUBG
- Chevron AW Hydraulic Oil 32
- G-C lubricants light AW R&O
- Mobile DTE 24
- Shell Tellus32
- Gulf Harmony 32

To prime the lubricator, find an air line on the carriage section of the machine that is energized, and disconnect it, allowing the air stream to bleed air pressure away from any persons. Direct the air stream at the machine so you can see when there is an oily film blowing out of the air hose. Repeat this same procedure for the back section and other trouble areas.

It is recommended to check the lines every week to two weeks.

Lubrication Points on the 994-X

Feed System

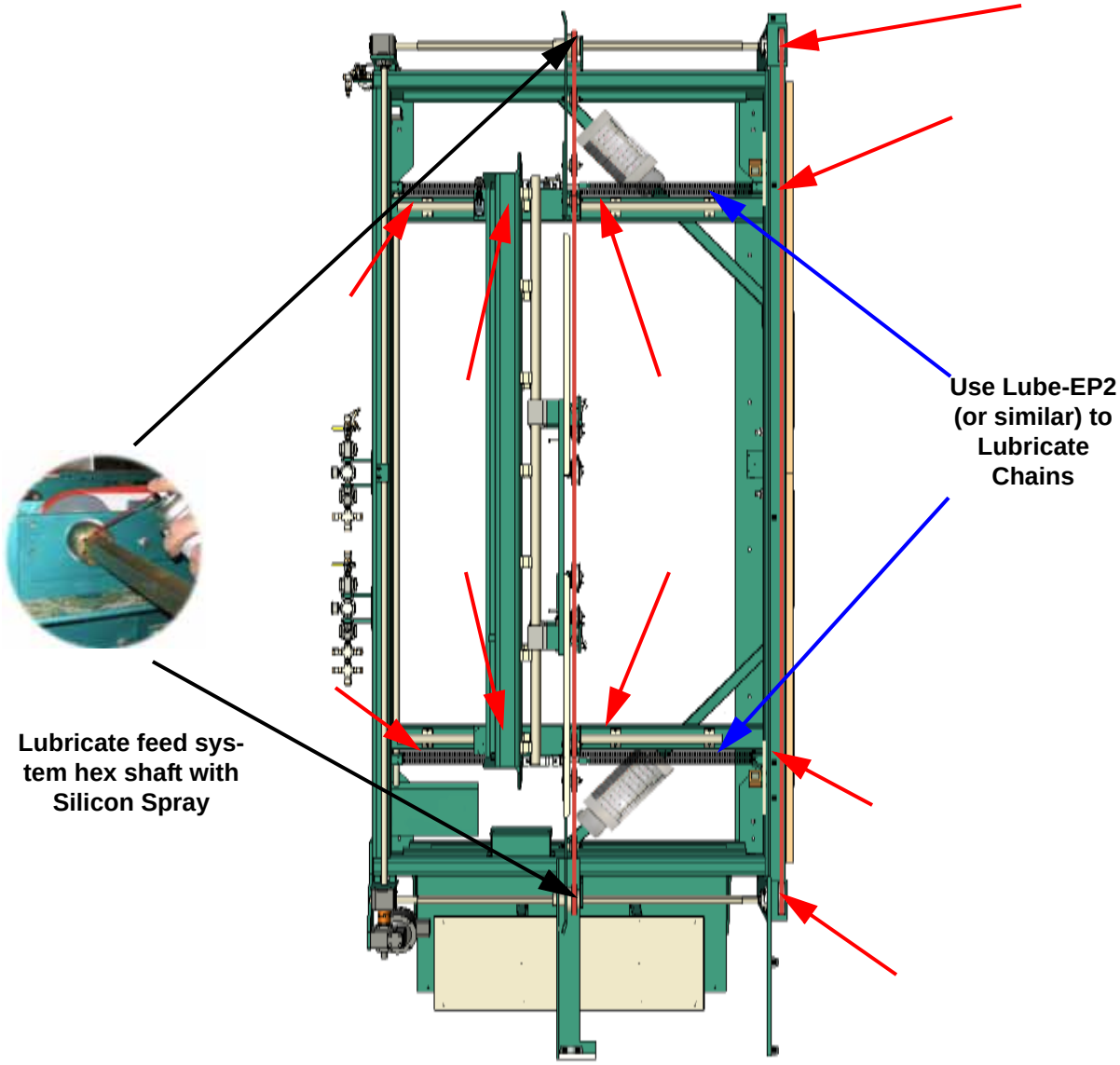


FIGURE5- 5. **Feed System Lubrication Points**

Replacing Bits

Caution

The 994-X is a powerful electro-mechanical motion control system. If servicing the 994-X follow the safety guidelines described in. Failure to do so can result in damage to equipment and/or serious injury to personnel.

Replacing Bits in the Front Section

This section describes the steps to change the pre-drill bits, router bits, and chisels in the heads on the front section., shows the locations of the replaceable parts inside the heads

.

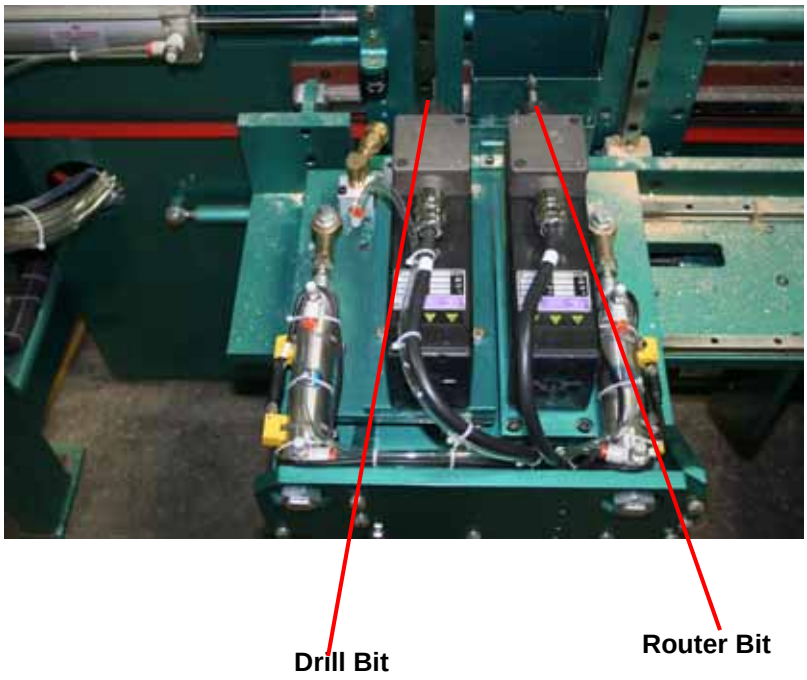
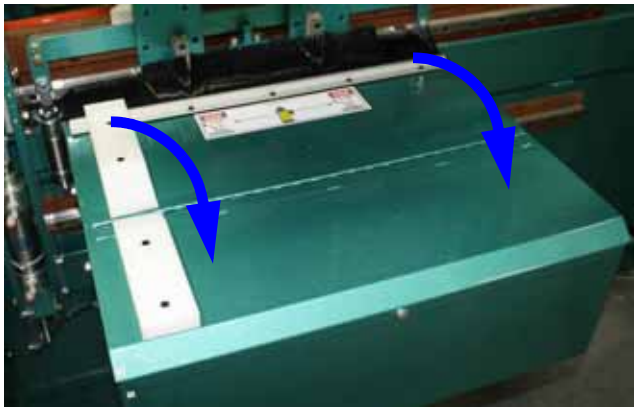


FIGURE5- 6. Location of Bits in the 994-X Heads

How to Access to Bit Assemblies

1. Shutdown the machine and follow the “Lock Out Tag Out procedures.
2. After machine is locked and tagged out, loosen remove the screws from the Top Dust Cover.
3. Fold back cover to access the bit assemblies.



Remove and Replace the Router or Pre-Drill Bits

After lockout tagout and access has been obtained to the assemblies, follow these instructions to remove and replace the router bit or the pre-drill bit.

1. Use a 17 mm shaft wrench and a 3/8 “collet wrench to remove the bit on the pre-drill or router assemblies.See Figure below.

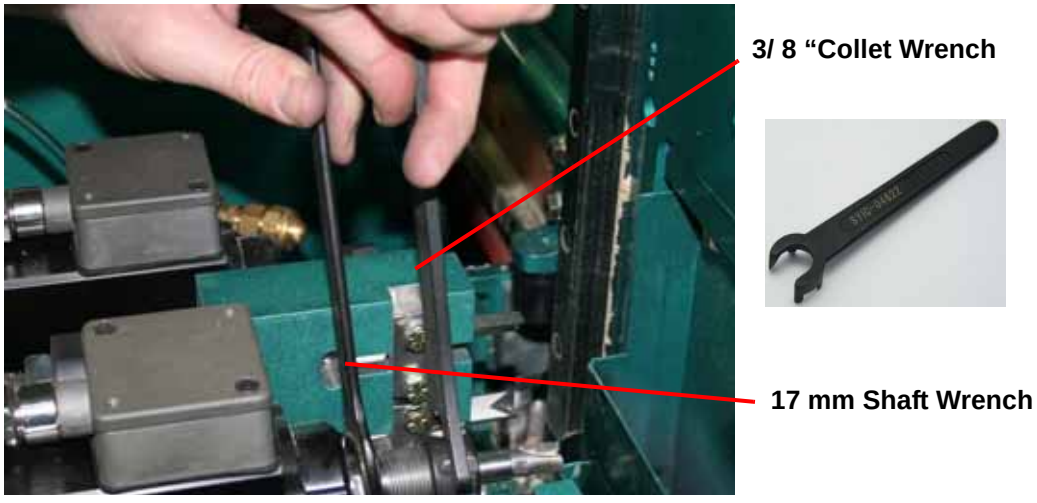


FIGURE5- 7. Removing Pre-Drill or Router Bit.

2. Inspect and clean collet assembly.

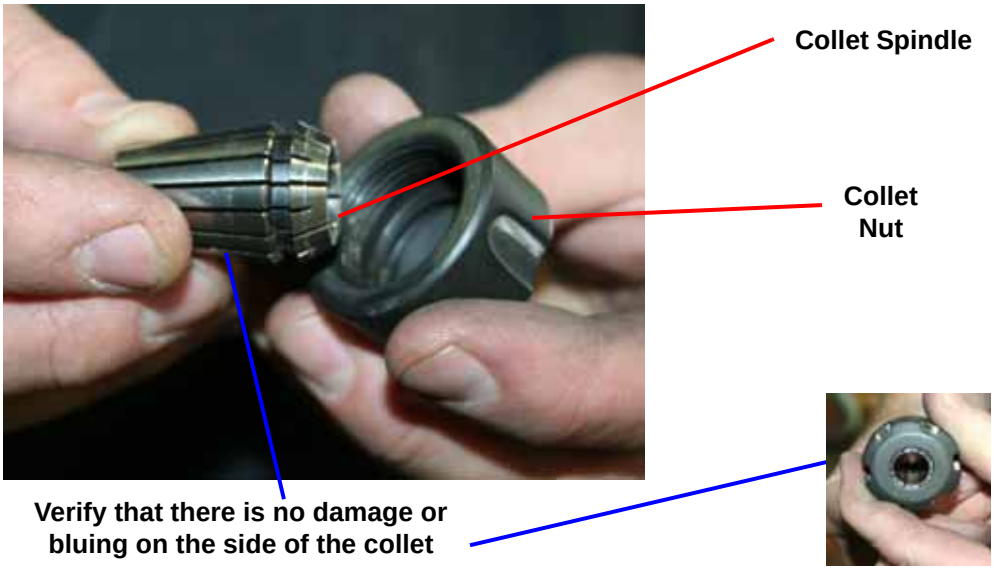


FIGURE5- 8. **Collet Assembly**

3. Lightly attach collet assembly on drill.

4. Insert the new bit into the assembly.

5. Before tightening the collet assembly, adjust the bit depth. Set the router bit to 1 3/4 “and the drill bit to 2.0” from the base of the collet nut to the tip of the bit. If available, use the Router Bit Depth Gauge (PN 432 C) to set the depth of the drill.

Note: Make sure the arbor is not bottomed out in the back of the motor. If it is the arbor will not tighten and will damage the collet or other machine parts.

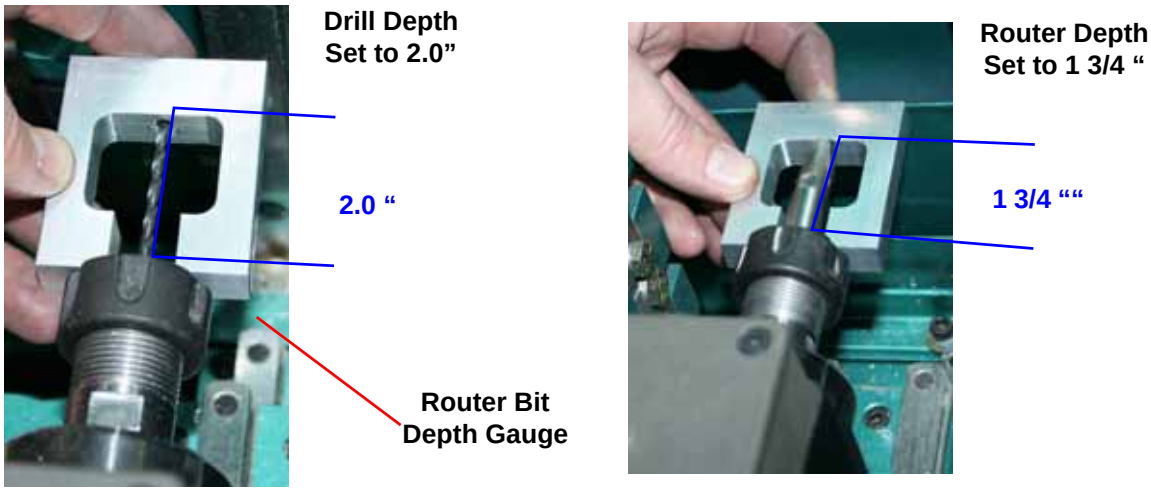


FIGURE5- 9. **Setting the Bit Depths**

6. Tighten the collet assembly.

7. Inspect and verify the work. Clean the work area.
8. If maintenance is completed, replace dust cover and tighten bolts.
9. orientation of the chisel

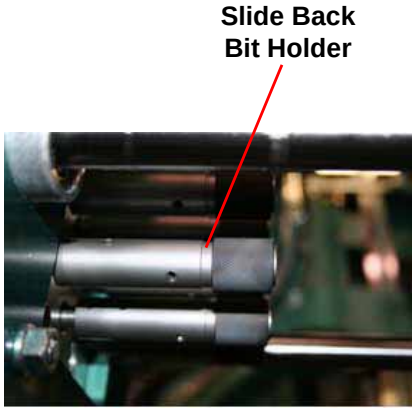
Remove and Replace the Screwdriver Bits

To replace screwdriver bits on the Six-Shooter heads, follow the instructions below.

1. Turn off all power to the machine. Follow proper lockout/tagout procedures as detailed in the safety section of Chapter 1 of this manual.
2. Disconnect air from Six-Shooter using the air-connect slide valves. Slowly slide the valves back toward you; listen for air to be released.
3. Pull the Six-Shooter assembly toward the machine-it will move slightly.
4. Locate the back slide near the air valves (see images); push slide away from you. This allows for movement of the Six-Shooter assembly away from the machine.

5. Move the Six-Shooter assembly away from the machine-it will move about 1½ inch. This provides room for hands to access the screwdriver bit holders.

6. To remove screwdriver bit, push the bit holder (see images) back toward the Six-Shooter assembly and hold: pull bit out of holder.



7. To insert screwdriver bit, push bit holder back toward Six-Shooter assembly and hold while inserting new bit. Release holder to secure bit.
8. Move Six-Shooter assembly back toward machine and pull the back slide toward you; then move assembly away from machine to restore assembly to original starting position

Back Section

Follow the instructions in this section to change the bits on th Bore Drill, Bolt Drill, and the Face Plate Router.

Caution: Turn off all power to the machine. Follow proper lockout/tagout procedures as detailed in the safety section of Chapter 1 of this manual.

Changing the Bore Drill

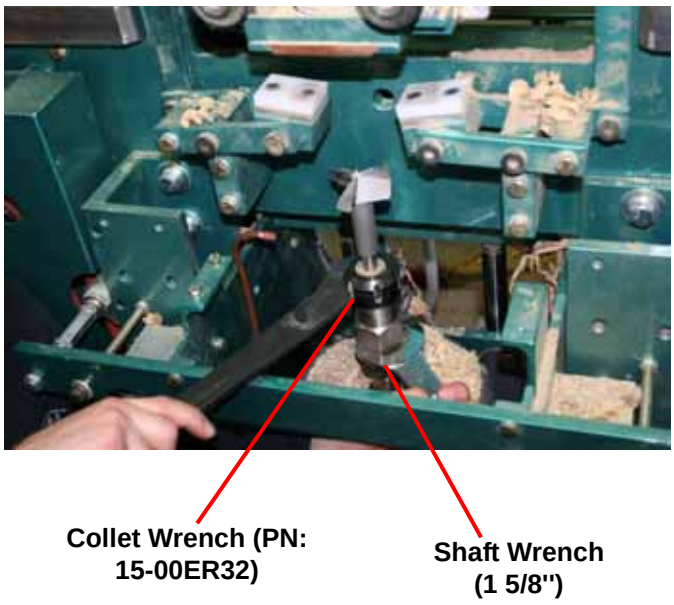
1. Use the shaft wrench and collet wrench to remove the bit on the pre-drill or router assemblies. See photo.

   When loosening the collet, it may tighten up, crack again and continue.

2. Inspect and clean collet assembly. Figure 5- 8 on page 10.

3. Insert the new bit into the assembly.

4. Before tightening the collet assembly, adjust the bit depth. Bottom out the bit and pull the bit up about 1.4".



Note: Make sure the arbor is not bottomed out in the back of the motor. If it is the arbor will not tighten and will damage the collet or other machine parts.

Note: The figure shows the cover off for training purposes..

Changing the Bolt Drill

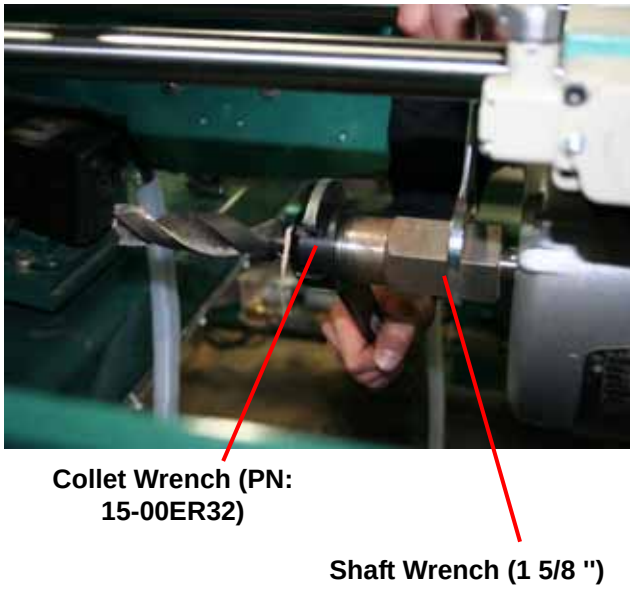
1. Use the shaft wrench and collet wrench to remove the bit on the pre-drill or router assemblies. See photo.

2. Inspect and clean collet assembly. Figure 5- 8 on page 10.

3. Insert the new bit into the assembly.

4. Before tightening the collet assembly, adjust the bit depth. Bottom out the bit and pull the bit up about 1.4".

Note: Make sure the arbor is not bottomed out in the back of the motor. If it is the arbor will not tighten and will damage the collet or other machine parts.



Changing the Face Plate Router

See “Remove and Replace the Router or Pre-Drill Bits” on page 5-9 . The motor and bits are the same configuration.

CHAPTER 6 Troubleshooting the 994-X

This chapter describes troubleshooting steps to help technicians solve issues that may occur with your KVAL machine. If help is needed, call or contact our KVAL Service team at (800) 553-5825 or http://www.kvalinc.com.

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Note: Refer to the Air and Electrical drawings provided with delivery of the machine. The drawings are normally located in the Electrical Panel. If copies are unavailable, contact the KVAL Service Department. Have drawings numbers, model number, and serial number of machine readily available.

About Motion Control

This section describes the positioning systems found in KVAL machinery. There are three basic types of motion control methods used in KVAL Machinery.

Sequencing:

Sequencing is a series of events executed in a predetermined order. Most KVAL machines use a form of sequential motion control. A typical series of events for a KVAL machine are:

1. Move the door into position.
2. Clamp the door.
3. Make the cuts.
4. Unclamp the door.
5. Move the door out.
6. Wait for the next door.

Point to Point:

Point to point motion control involves moving a load from one fixed position to another fixed position at a constant speed and along one line (axis X,Y, or Z). A typical point to point would be a drill with a fixed-depth. The drill is either retracted or extended using a pneumatic cylinder. Typically the drills travel is limited by physical stops.

Incremental:

Incremental motion control is used when the load is required to be moved with high accuracy to multiple locations, sometimes in multiple directions (axes). A typical KVAL usage for this system is a computer controlled router in a door light machine where there is great variety in the cut size, shape and location.

Basic Control Circuit

This section describes a basic control circuit. The Figure below shows a block diagram of a common control circuit. There are four parts to a motion control system:

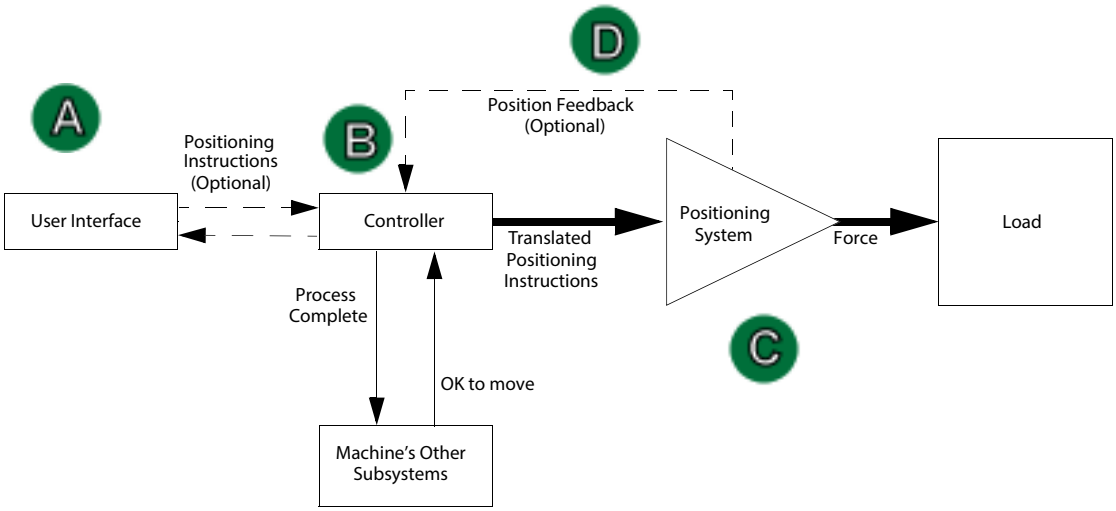


FIGURE 6- 10. Block Diagram of Basic Motion Control

A The User Interface:

- Allows communication between the humans and the machine.

Examples: A touch screen, a PC or a button panel.

B The Controller:

- Translates entered information into a form the positioning system can understand.
- Listens to the machine's other subsystems waiting for the OK to move command.
- Sends the positioning instructions to the positioning system.
- Listens to the positioning system for position status (if there is a feedback loop).
- Tells the machine's other subsystems when the move process is completed.

Examples: A PLC or a dedicated motion control board.

C Positioning System:

- Moves the load.

Examples: A motor or a pneumatic cylinder.

D The Position Feedback.

- Provides location information to the controller.

Examples: A limit switch, a photo eye, or ferrous eye, a resolver or an encoder

Typical Positioning Systems

Common Contactor Control

Unlike general-purpose relays, contactors are designed to be directly connected to high-current load devices. Contactors are designed to control and suppress the arc produced when interrupting heavy motor currents.The figure below shows a block diagram of a typical contactor circuit with typical voltages.

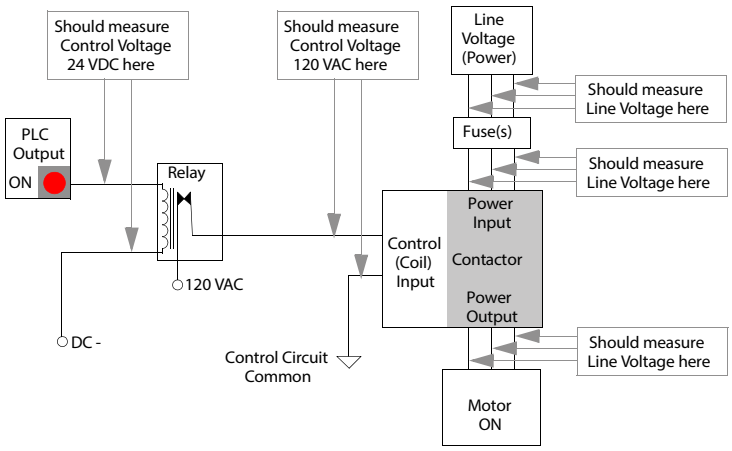


FIGURE 6-11. Block Diagram of a Common Contactor Circuit

Common Motor Drive Control

An adjustable-speed drive is used to control the motor speed and torque by varying motor input frequency and voltage. A variable-frequency drive (VFD) is used in KVAL machinery. The figure below shows a block diagram of a typical motor drive circuit with typical voltages.

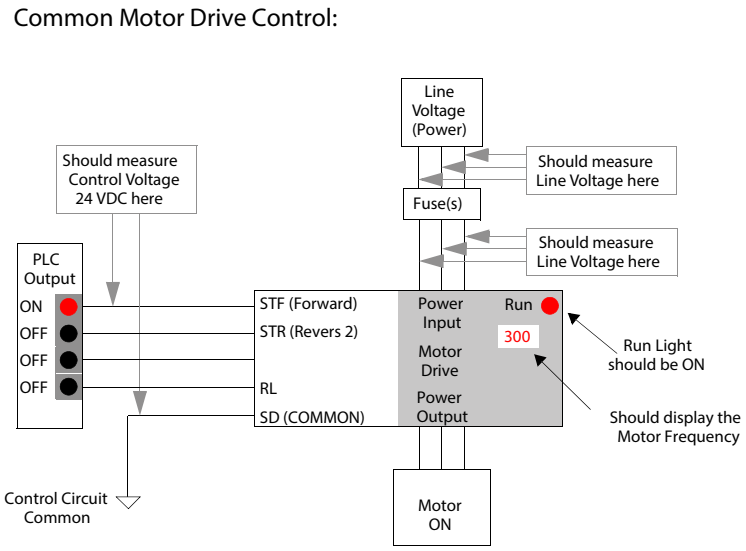


FIGURE 6- 12. Block Diagram of a Common Drive Control

Typical Positioning System Pneumatic Circuit

A control valve (solenoid) is used to drive cylinders to move different loads in the machine. For Example: extending and retracting router, drill, clamping a door.

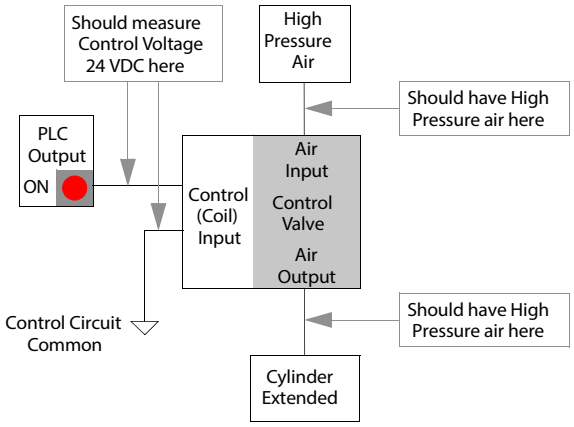


FIGURE 6- 13. Block Diagram of a Pneumatic Circuit

Troubleshooting Basics

Good trouble shooting starts with looking at the whole machine, where every part is suspect. Then narrowing down the view to the bad part.

Ask: Ask basic questions. For example:

- What was the Machine Trying to Do?
- What Was the Machine Trying to Do Next?
- Was the machine working before?
- Did it happen on first power up or during process?

Narrow: Narrow or determine the sequence and subsystem where the issue occurs. For example:

- Did the issue happen when door was being fed in?
- Is the router not cutting?
- Is the cut out of specification?

Note: See Table 6-1 on page 8 for sequence and subsystem information.

Verify: Verify or analyze the subsystem assembly that is responsible for the issue. For example:

- How is the subsystem supposed to work?
- What is keeping the subsystem from working?

Note: See“Analyze the Sub Systems” on page 6-8 for information on verifying and analyzing subsystems.

Before you Adjust

Sometimes simple problems can seem to be complex issues. Before making adjustments, check for the following common issues.

1. Is the loaded setup correct for the current cut?
2. Are the stops set up correctly?
3. When did the problem first start?
   - At first Start-Up?
   - During the Run?
4. When was the last calibration?
5. Is the door true?
6. Use Router Bit Depth Gauge (PN: 432C) to check depth of Bits
7. Check tools for wear.
8. Check back side of “H” blocks for sawdust build-up, which may affect depth.

Basic Troubleshooting Steps

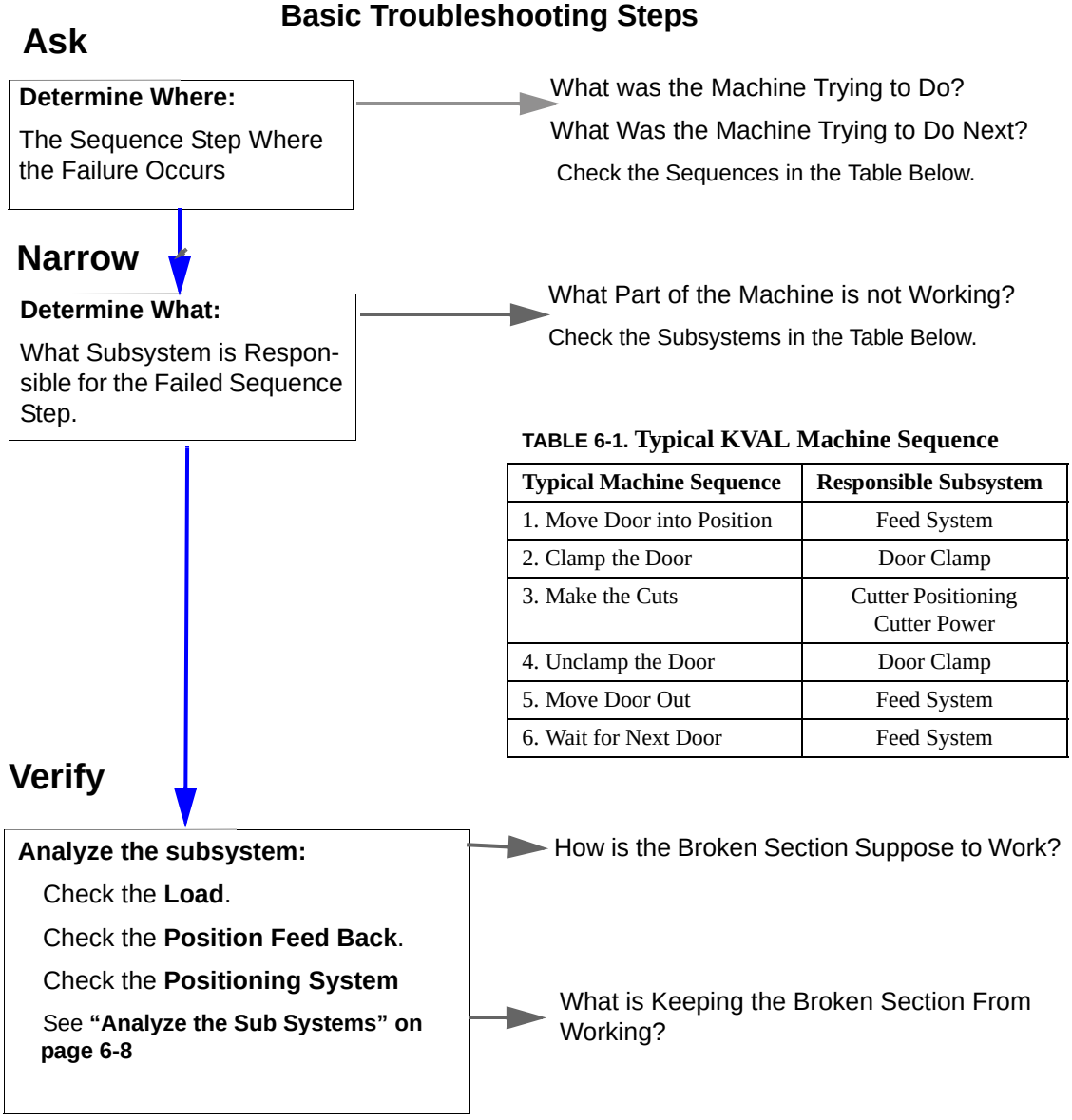

Ask
Determine Where:
The Sequence Step Where the Failure Occurs
What was the Machine Trying to Do?
What Was the Machine Trying to Do Next?
Check the Sequences in the Table Below.
Narrow
Determine What:
What Subsystem is Responsible for the Failed Sequence Step.
What Part of the Machine is not Working?
Check the Subsystems in the Table Below.
Verify
Analyze the subsystem:
Check the Load.
Check the Position Feed Back.
Check the Positioning System
See "Analyze the Sub Systems" on page 6-8
How is the Broken Section Suppose to Work?
What is Keeping the Broken Section From Working?

TABLE 6-1. Typical KVAL Machine Sequence

Typical Machine Sequence	Responsible Subsystem
1. Move Door into Position	Feed System
2. Clamp the Door	Door Clamp
3. Make the Cuts	Cutter Positioning Cutter Power
4. Unclamp the Door	Door Clamp
5. Move Door Out	Feed System
6. Wait for Next Door	Feed System

Analyze the Sub Systems

1. Check the **Load** for mechanical issues

- Is the Load "bound up?
- Is there sufficient lubrication?
- Is it an alignment issue?
- Is anything damaged?

2. Check the **Position Feed Back**.

- Does the **Position Feed Back** agree with the **Load** position?

In other words are the correct photo eyes, limit switches or ferrous sensors activated? Check the controller inputs to insure the proper sensors are activated. If the controller is a PLC, an activated input is lit. Some touch screens have inputs status also.

3. Common Position Feedback failures:

- **Photo Eye:** Bad element or bad cable
- **Limit Switch:** Stuck, or failure
- **Wiring:** Broken, worn insulation
- **PLC:** Bad input port.

4. Check the Positioning System

Follow the circuit from the **Controller** output to the **Load** and check for component failures.

Using Sensors to Trouble Shoot

- Photo Sensors often get dirty. Make sure they are clean. If they are not clean, debris blocks the signal.
- Check output voltages of the sensors in the **active** mode. The voltage should effectively equal **0 VDC**
- Check the output voltages of the sensors in **inactive** mode.The voltage should effectively equal **24 VDC**

Location of Sensors on 994-X

Figure 6- 14 below, shows the sensor locations on the 994-X The “I” designation represents an input to the PLC and the “Q” designation represents an output from the PLC.

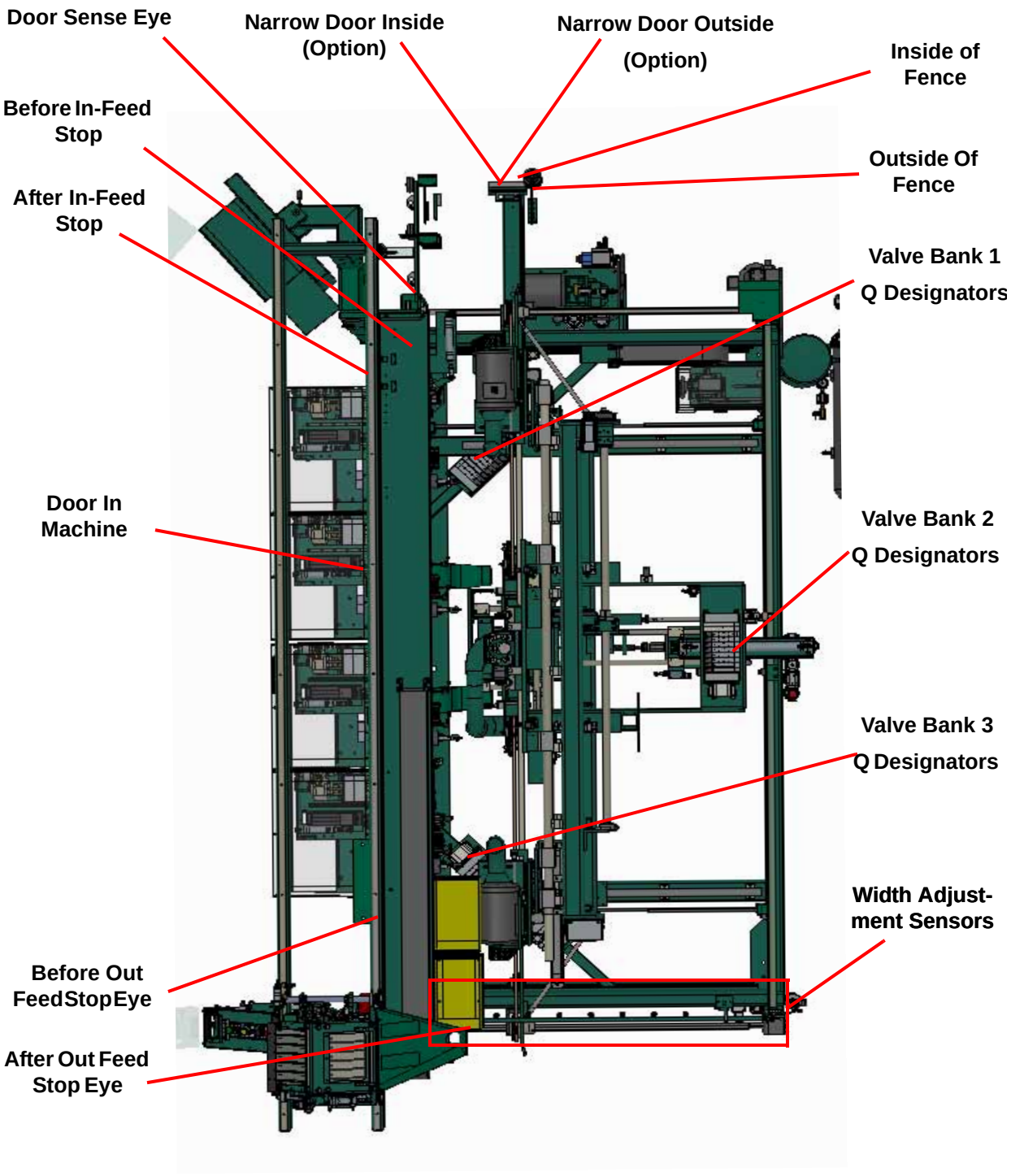


FIGURE 6- 14. **Location of Sensors Top View 994-X**

Z Axis and Y Axis Front Section Sensors

Figure 6- 15 below shows the placement of the **Z-Axis** sensors and the **Y-Axis** sensors. The **Y-Axis** sensors sets the maximum limits in positive and negative vertical movement and also sets the home position. The **Z-Axis** sensors sets the maximum limits in positive and negative depth movement and also sets the home position.

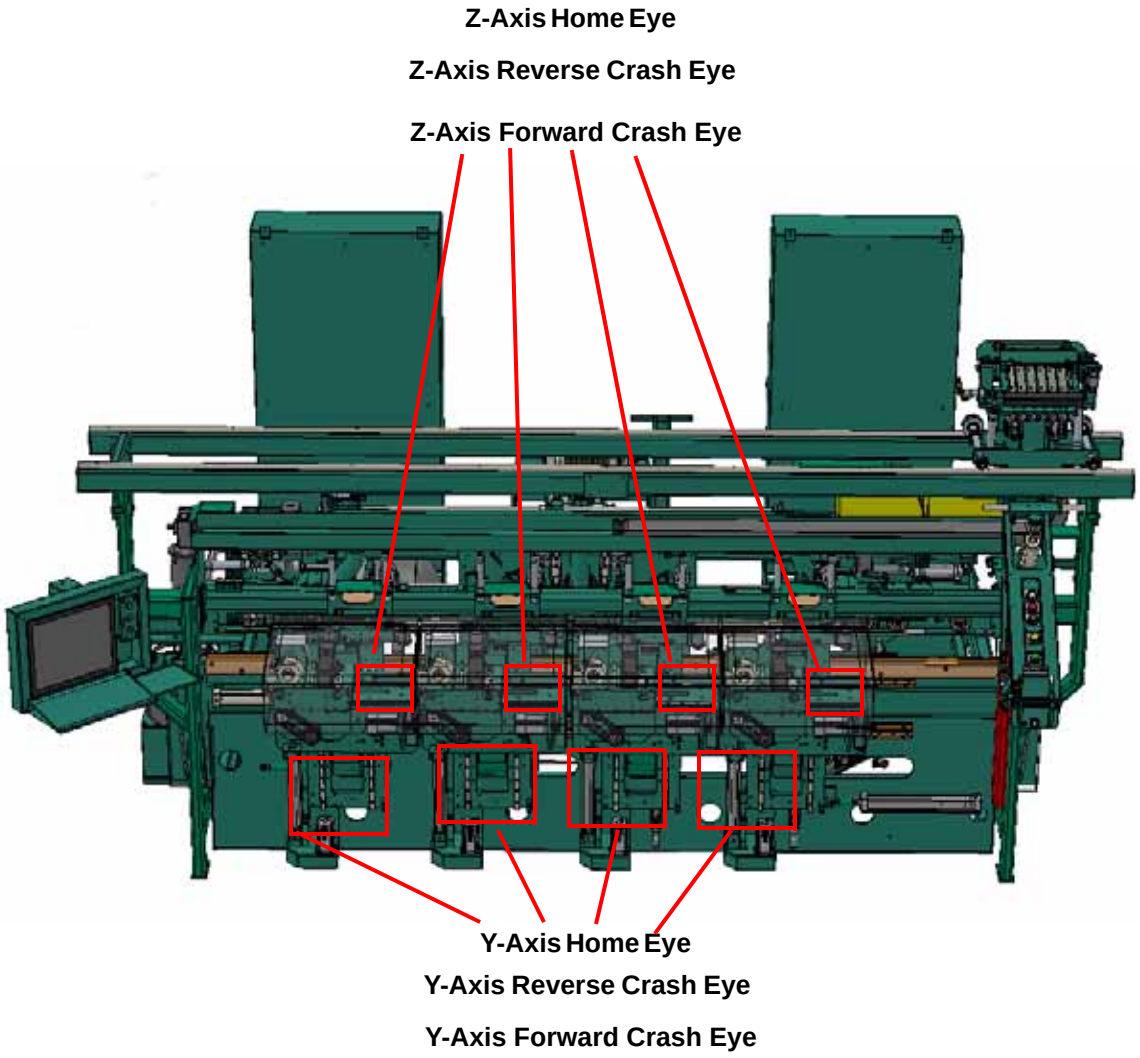


FIGURE 6- 15. **Figure 6- 15 Section View of 994-X Y and Axis Sensors**

X Axis Sensors Front Section

Figure 6- 16 below, shows the placement of the **X-Axis** sensors. The X**-Axis** sensors sets the maximum limits in positive and negative positions and also sets the home position. The sensors are located underneath the Heads

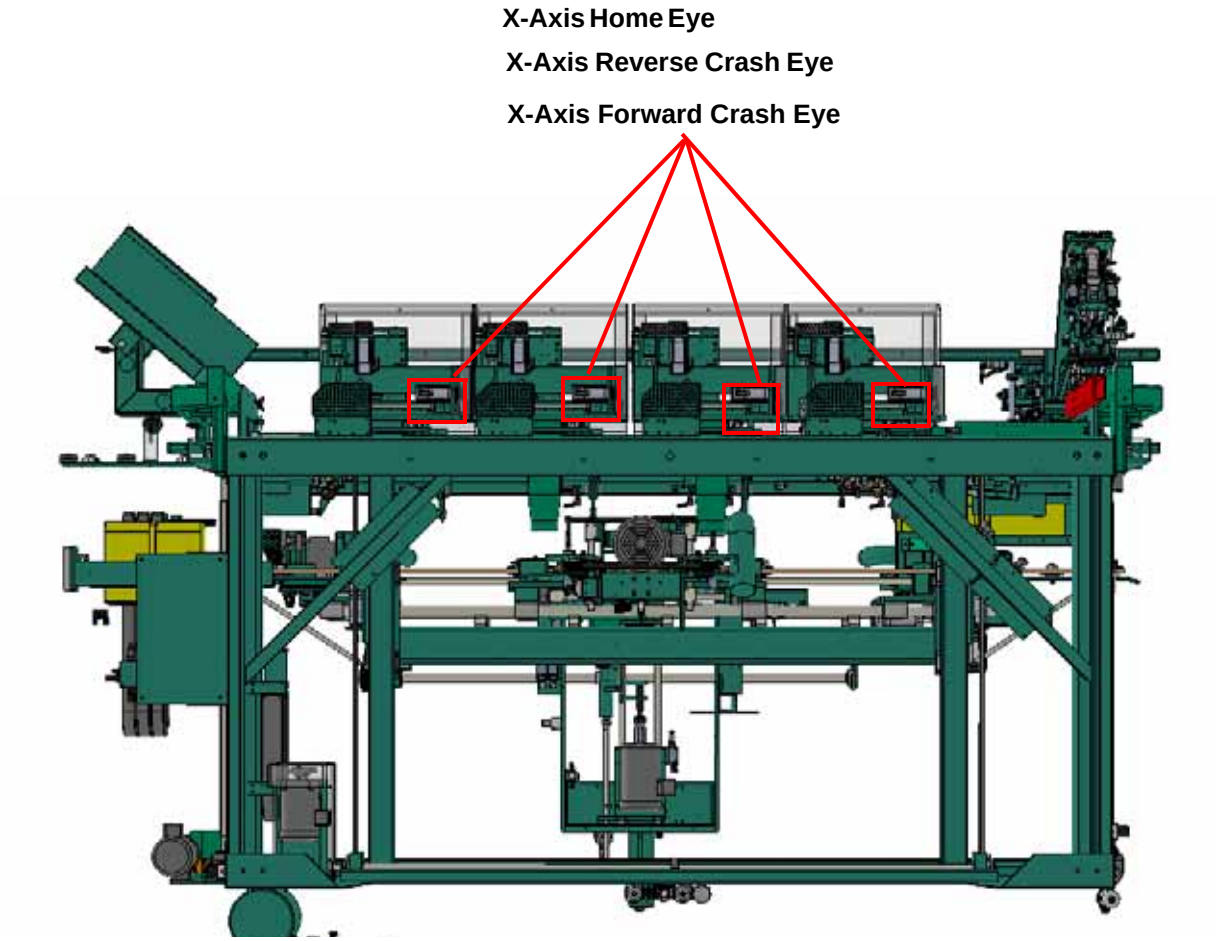


FIGURE 6- 16. Bottom View of 994-X location of X Axis Sensors

Troubleshooting Electrical Problems

NOTE: Refer to Air and Electrical Schematics provided with delivery of the machine. Schematics are located in the Electrical Panel. If copies are unavailable, contact the KVAL Service Department. Have model number and serial number of machine readily available.

Warning The following checks require the electrical panel to be energized. These troubleshooting checks *must* be performed by a **Qualified Electrical Technician.**

The electrical component systems are designed to expedite the troubleshooting process and minimize "down time". In general, component systems have the input or feed functions at the top. Output or load functions are positioned at the bottom. Most two-voltage electrical panels are designed with the LOW VOLTAGES on the LEFT, and the HIGH VOLTAGES on the RIGHT. The majority of the system components are labeled with numbers that correspond with the electrical prints included in the electrical box door.

Computer controlled machines have signals on the computer that light up when the input or output functions are energized, respectively. Computer controlled as well as non-computer controlled machines have white 120V control power terminal strips. This will indicate power supply from the respective circuits.

PLC controllers also have lights on them for the input and output functions. You can easily find out which circuits are failing by watching the lights turn on or off. Compare the lights on the IDEC or Beckhoff controllers to the electrical print to determine what systems are being affected.

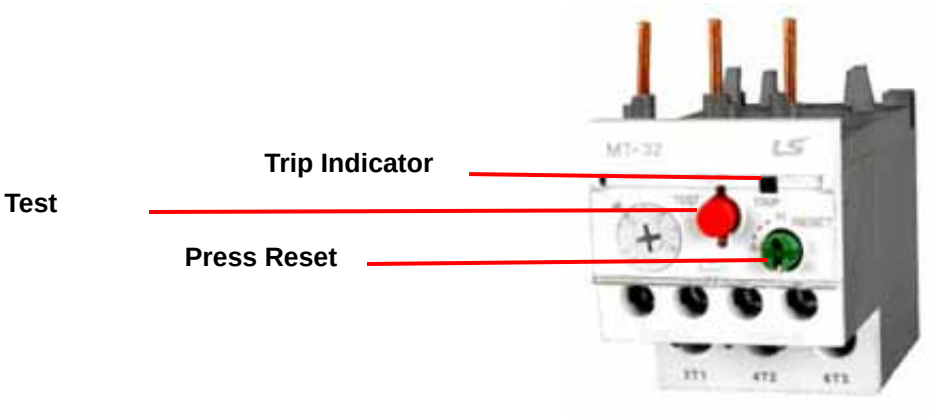
If the Power Stops During Normal Operation

1. Check that the input power disconnect switch is not turned off.
2. Check that all of the emergency stop buttons are in the normal position.
3. Check the Six Lights on the Electrical Panel. See "Troubleshooting with the Status Light Panel" on page 6-15.

Lockout and Tagout the main power source.

1. Turn the panel disconnect switch in the off position, open the electrical panel door.
2. Observe the disconnect switches. Look for loose or broken wires at the disconnect then at all of the components.
3. Check for continuity of all fuses with an OHM meter. (Fuses need to be removed from the bottom side of the fuse holder before measuring the fuses)

4. With the power off, check for motor overloads by pressing each reset button (usually at the bottom of the panel) in SEQUENCE. If one is tripped there will be a slight resistance to touch and a “click” sound as it is reset.



Thermal Overload Relay

Check for Tripped Circuits

1. Remove lock and tag outs on the main power sources.
2. Manually close disconnect sensors and energize the control circuit or transformer with its respective sensor. Check the Status Light Panel,. If all lights are observed, there are no overloads or emergency stops tripped. See” *Troubleshooting with the Status Light Panel* “below, for more information.

Note: Most electrical problems are related to mechanical malfunction (e.g., stuck motors, jammed chain, blocked photo sensors etc.)

Note: If a solenoid valve is suspected, and not cleared in the air checks section (see), it can be electrically jumped to check operation.

Troubleshooting with the Status Light Panel

The Status Light Panel is located on the Electrical Panel. All six lights are illuminated when the system is in proper working order. The lights turn on in a sequence and will stop at the point where a fault is first detected.

The sequence that the lights turn on are as follows:

1. Control Power (Amber)
2. Overload Relay (Amber)
3. E-Stop (Amber)
4. Stop (Amber)
5. Start (Amber)
6. 24VDC (Green)

If one or more lights are OFF, follow the process below to isolate the cause.

NOTE: Be sure to proceed down the table, starting with the CONTROL POWER light.

STEP 1:Control Power (Amber). If light is OFF go to item **A** on page 6-17.

STEP 2:Overload Relay (Amber) If light is OFF go to item **B** on page 6-18.

STEP 3:E-Stop (Amber) If light is OFF go to item **C** on page 6-18.

STEP 4: Stop (Amber) If light is OFF go to item **D** on page 6-18.

STEP 5: Start (Amber) If light is OFF go to item **E** on page 6-19.

STEP 6: 24VDC (Green light is OFF go to item **F** on page 6-19.

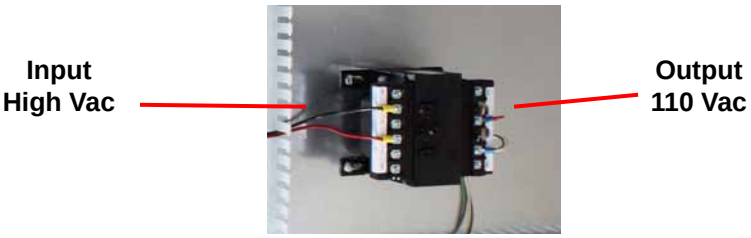
Control Power Light OFF

1. Check if the Control Transformer button is pulled out.

2. Is the Disconnect Switch on the main electrical cabinet set to ON?

3. Is there 208, 220, 440, or 575 VAC to the top side (input) of the Control Transformer? If not, check the fuses at the Fuse Block, and the contacts on the Control Transformer button on the switch panel.

Typical Control Transformer



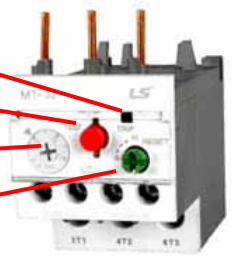
4. Is there 110 VAC between #1 & #2 on the 110 VAC Terminal Strip? If not, check the fuse on the output side of the Control Transformer. If fuse is good, check power coming out of Control Transformer.

5. If no power on the output side, and there is power going into the top of the Control Transformer, replace the Control Transformer.

6. If there is power at the Control Transformer, check the wiring of the black and white wire going from the Control Transformer to the 110 VAC Terminal Strip.

B Overload Relay Light OFF

1. Check Motor Overload Circuits
2. With power on, check the trip indicator LED on the overload. If indicator is orange, press the Reset Button to reset the overload circuit. Retest the Machine.



C E-Stop Light OFF

Check to see the if any E-Stop buttons are pulled out.

NOTE: Location and quantity of E-Stop buttons varies depending on customer need. Typical locations for E-Stop buttons are near the Rear Access Gate and near the Tool Changer Access Gate

D Stop Light OFF

Check for 110 VAC between #2 and #4 If there is voltage, press the Start button. If no voltage, check the Stop button to make sure it is all the way out and not stuck in, then check the contact to make sure it is closed. If still no voltage, check the wiring.

Start Light OFF

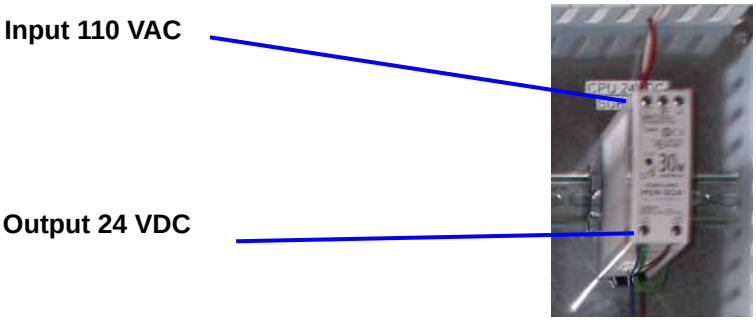
If the Start light remains unlit, push in the Start button and hold it in while a second person checks for voltage between #2 and #~~7~~5. If there is 110 VAC, replace the ACR relay. If there is no voltage while the button is held in, check the wiring.

24VDC Light OFF

First isolate the power supply. Check between DC+ and DC- for 24VDC. If no DC voltage, disconnect the output (V+ and V-) wires from the 24VDC power supply-and check for DC voltage where those wires were disconnected.

If no voltage:

Check the input side for 110 VAC. If no 110 VAC, check the fuse. If there is 110 VAC and no 24VDC, replace the 24VDC Power Supply.



If there is 24VDC:

Reconnect the output wires to the 24VDC power supply.

Trace the output wire to the DC terminal block.

Disconnect all (+ 24V positive) wires from the + DC from the DC terminal block except the + output wire from the + 24VDC power supply.

Check for +24VDC at between any –DC and +DC terminal on the DC Terminal block.

Reinstall the (+ 24V positive) wires one by one, checking for +24VDC after installing each. If at any point no voltage is found trace the last reinstalled wire and check for shorts.

About VFD Troubleshooting

This section describes some troubleshooting tools for the VFDs.

Error Checking on the Variable Frequency Drives

VFDs (Variable Frequency Drives) interact with hinge and faceplate routers, width adjust motors, and feed motors. If issues occur, error codes are displayed on the VFDs. To help troubleshoot, refer to the VFD manuals located in the High Frequency Panel for lists of the error codes. See “About the Electrical Panels” on page 2-13 for locations of VFDs.

Using the Reset Buttons

In some rare occasions an electrical spike may cause a VFD to shut down. The reset buttons are located on the door of the VFD panels. The button contains the VFD function printed on the button. If a VFD is tripped to “OFF” the button will be lit. To reset a VFD:

1. Push lighted button to reset the indicated motor
   a. If the button light turns off, continue with production.
   b. If the button stays lit, find the source of the down motor (printed on the button). For example if the feed thru motor is not working, at operator station turn the motor on and off to reset.
   c. If issue continues, get the error code off the VFD* and look up the error code in the VFD manual. Follow the instructions in the VFD manual. If issues continue, contact our Service Center. See “Getting Help from KVAL” on page 1-13 .

FIGURE 6- 17. **VFD Reset Buttons**

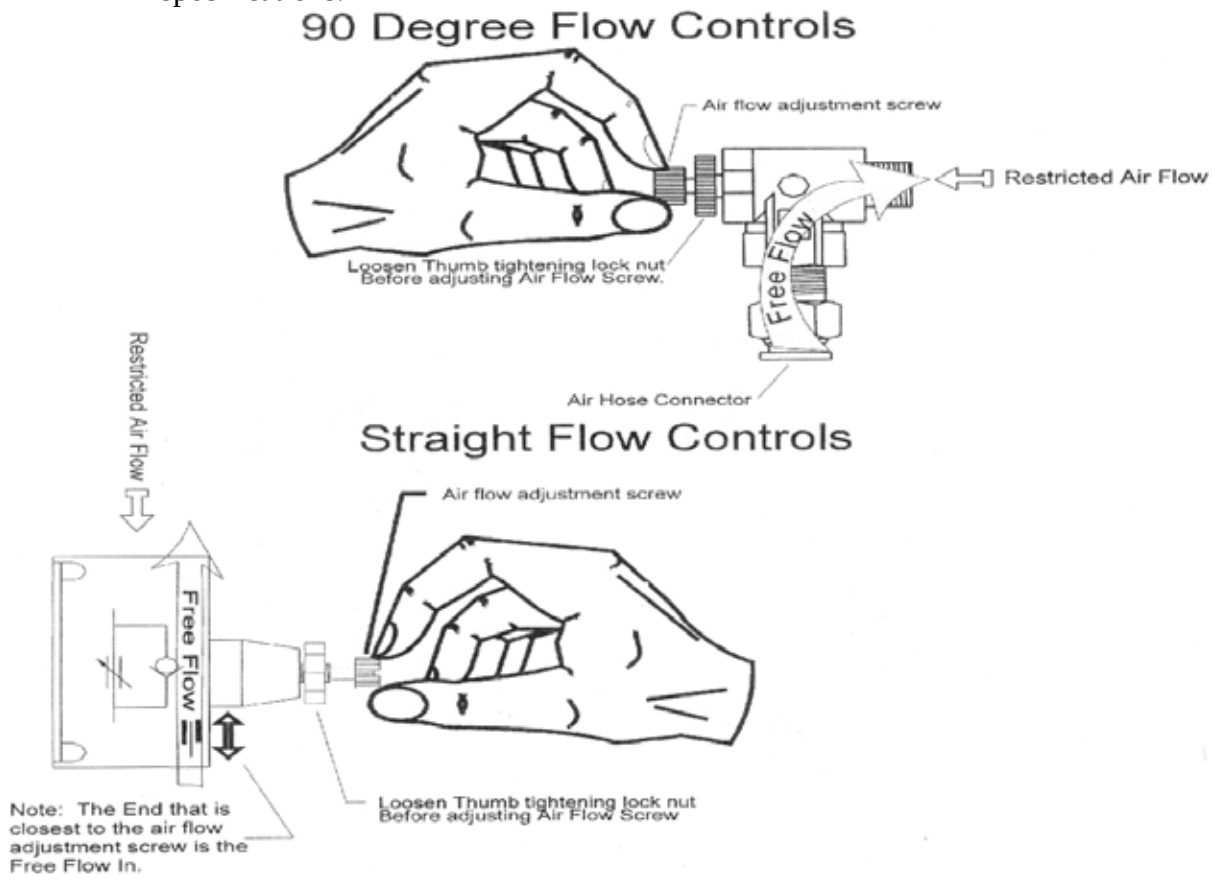
Note: The number of reset buttons depends on the machine type and option. The figure above shows a machine with 11 VFDs

Note: * The VFD manuals are located in the Electrical Panels. On some machines, documentation can be found in the operation station in the documentation folder.

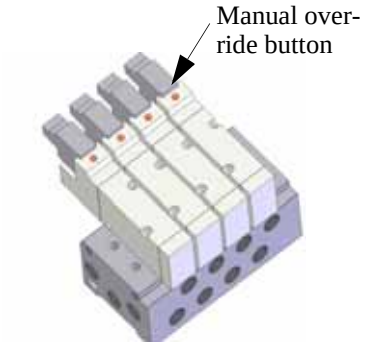
Troubleshooting the Air Cylinders

Most cylinders have an extend and retract port. To adjust the extend motion of a cylinder you must adjust the flow control on the retract port; this regulates the air flow exhausting from the cylinder and the opposite is true for the retract motion.

1. Check the air pressure to the machine.
2. Check the flow controls to see that they are adjusted correctly and to the proper specifications.


90 Degree Flow Controls
Air flow adjustment screw
Restricted Air Flow
Free Flow
Loosen Thumb tightening lock nut
Before adjusting Air Flow Screw.
Air Hose Connector
Straight Flow Controls
Restricted Air Flow
Air flow adjustment screw
Free Flow
Loosen Thumb tightening lock nut
Before adjusting Air Flow Screw
Note: The End that is closest to the air flow adjustment screw is the Free Flow In.

3. Check for any obstructions to the cylinders such as screws or a misplaced tool etc. FOLLOW ALL SAFETY GUIDELINES AND SIGNS DURING THIS PROCESS.



4. Check the solenoid air valves:

Caution Once activated, The valve will allow **full pressure to cylinder.** Make sure you are clear of all moving parts.

a. The solenoid valves can be manually operated by pushing the red manual override button on the end of the valve.

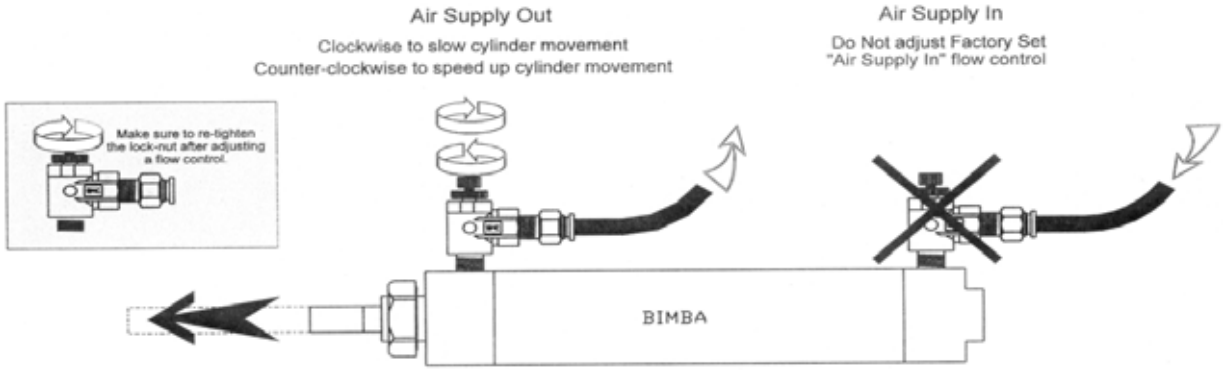
b. If the valve seems to be leaking, the seals may be dry or contaminated with water or it maybe that the cylinder "O" rings are damaged and air is passing from one side to the other side of the cylinder which means the air is exhausting through the solenoid valve. It maybe is necessary to purchase a rebuild kit or a new cylinder.

c. If the valve is not receiving an electrical signal, for instructions. It might be necessary to call in a specialist or check with KVAL customer service at 1-800-553-5825.

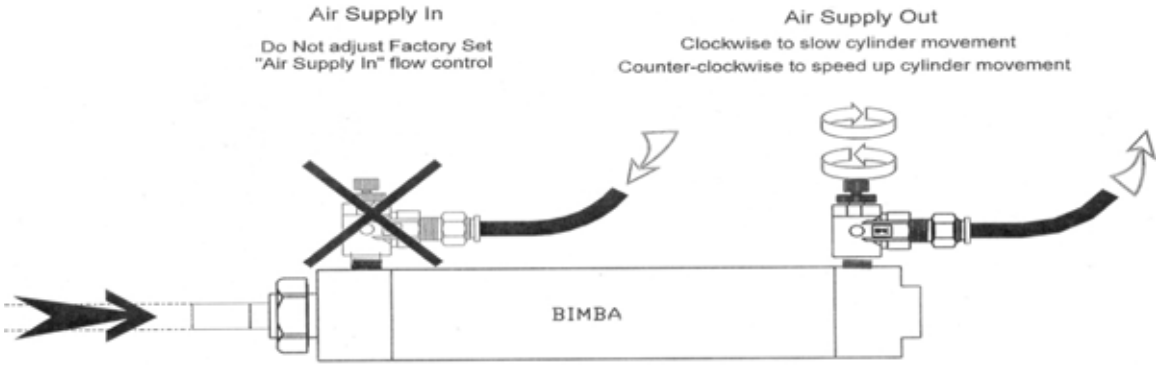
5. If an Air Leak is coming from an exhaust port on the solenoid air bank:

a. Check the solenoid for the manual override. If the solenoid has a manual override you can push each of the buttons one at a time. When the air leak stops or weakens it usually means that one or more of the cylinders that the solenoid is operating are faulty.

Adjusting Cylinder Extension Speed:


Air Supply Out
Clockwise to slow cylinder movement
Counter-clockwise to speed up cylinder movement
Air Supply In
Do Not adjust Factory Set
"Air Supply In" flow control
Make sure to re-tighten the lock-nut after adjusting a flow control.
BIMBA

Adjusting Cylinder Retraction Speed:


Air Supply In
Do Not adjust Factory Set
"Air Supply In" flow control
Air Supply Out
Clockwise to slow cylinder movement
Counter-clockwise to speed up cylinder movement
BIMBA

Network System Overview

A PLC controls the 994-X. The 994-X PLC can process multiple analog and digital inputs, and output arrangements. The system can handle extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact.

Figure 6- 18 below, shows the PLC connections in the 990-H. The PLC is located in the Main Electrical Panel. From the PLC, connections are made to coupler interfaces located near the sections they control. See your machine's schematic package for detailed wiring information.

To aid in troubleshooting, the next section shows the locations of the assemblies in the block diagram below.

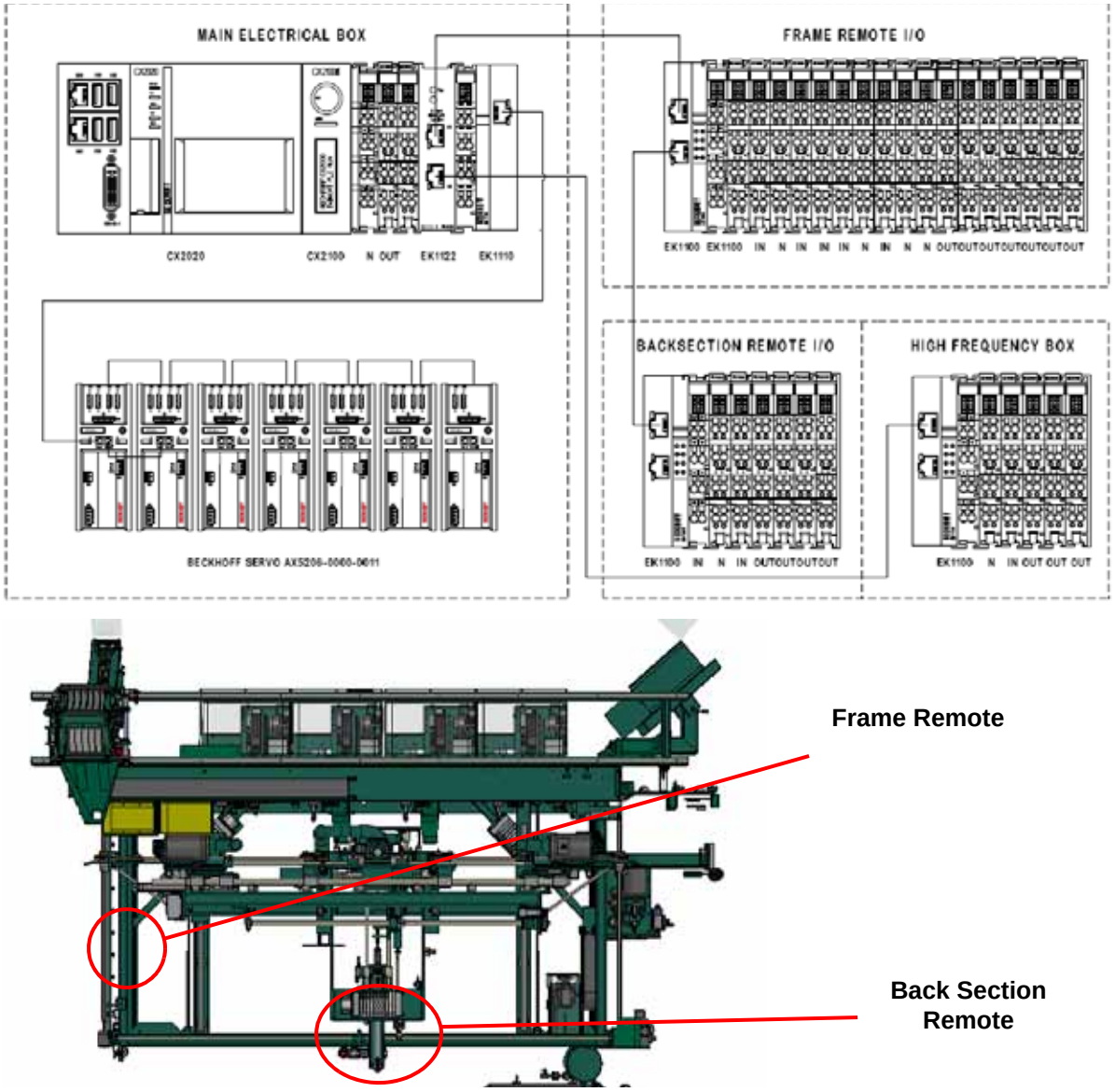


FIGURE 6- 18. Network Connections Block Diagram

Connections to Servo Drives

The Servo Drives are located in the Main Electrical Panel. The outputs connect to the following:

- Servo Drive 1: Head # 1 (X axis) and (Y axis) servo motors
- Servo Drive 2: Head # 1 (Z axis) and Head # 2 (X axis) servo motors
- Servo Drive 3: Head # 2 (Y axis) and (Z axis) servo motors
- Servo Drive 4: Head # 3 (Y axis) and (Y axis) servo motors
- Servo Drive 5: Head # 3 (Z axis) and Back Section (X axis) servo motors
- Servo Drive 6: Back Section (Y axis) and (Z axis) servo motors
- Servo Drive 7: Back Section Location and Feed Motor

For detailed wiring information, see your machine's electrical drawings.

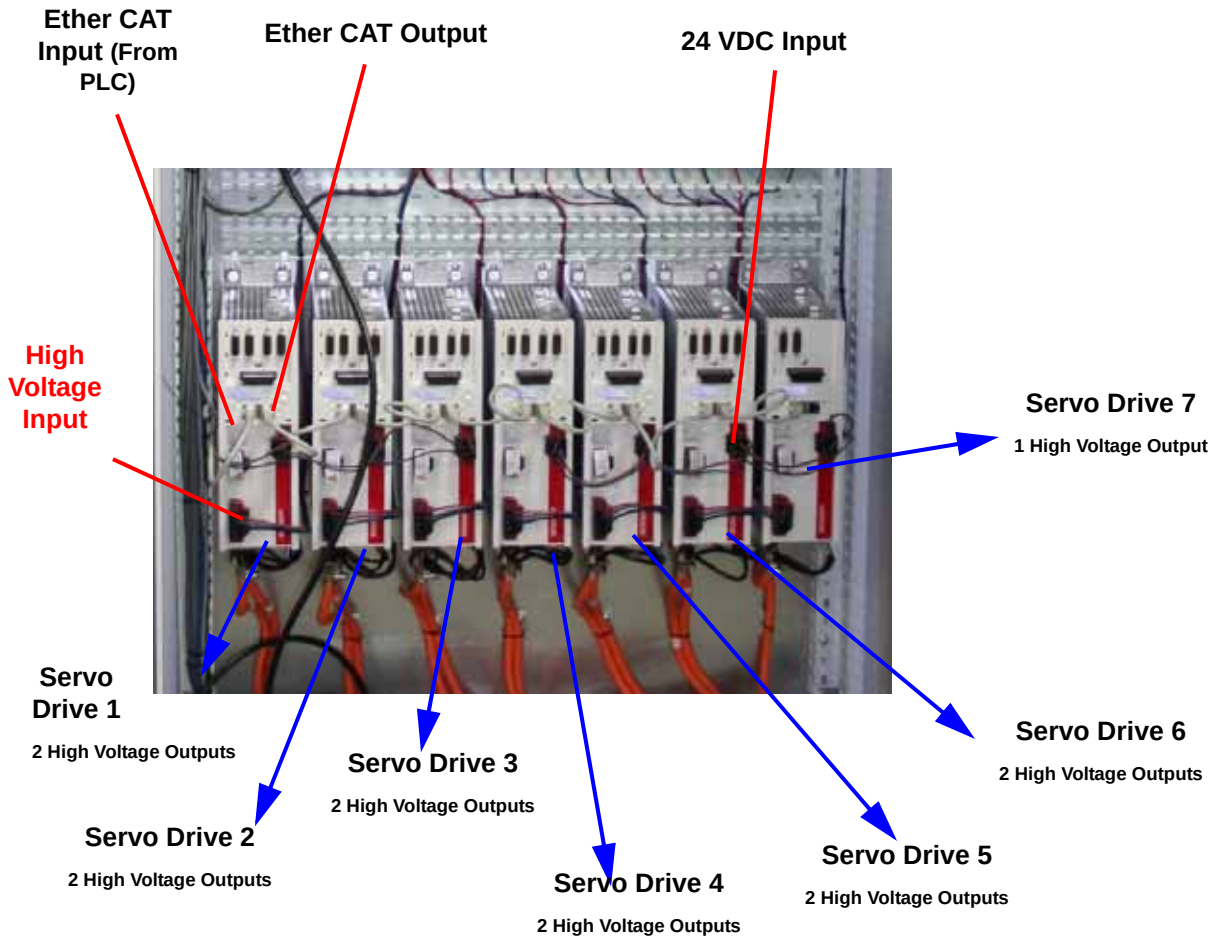
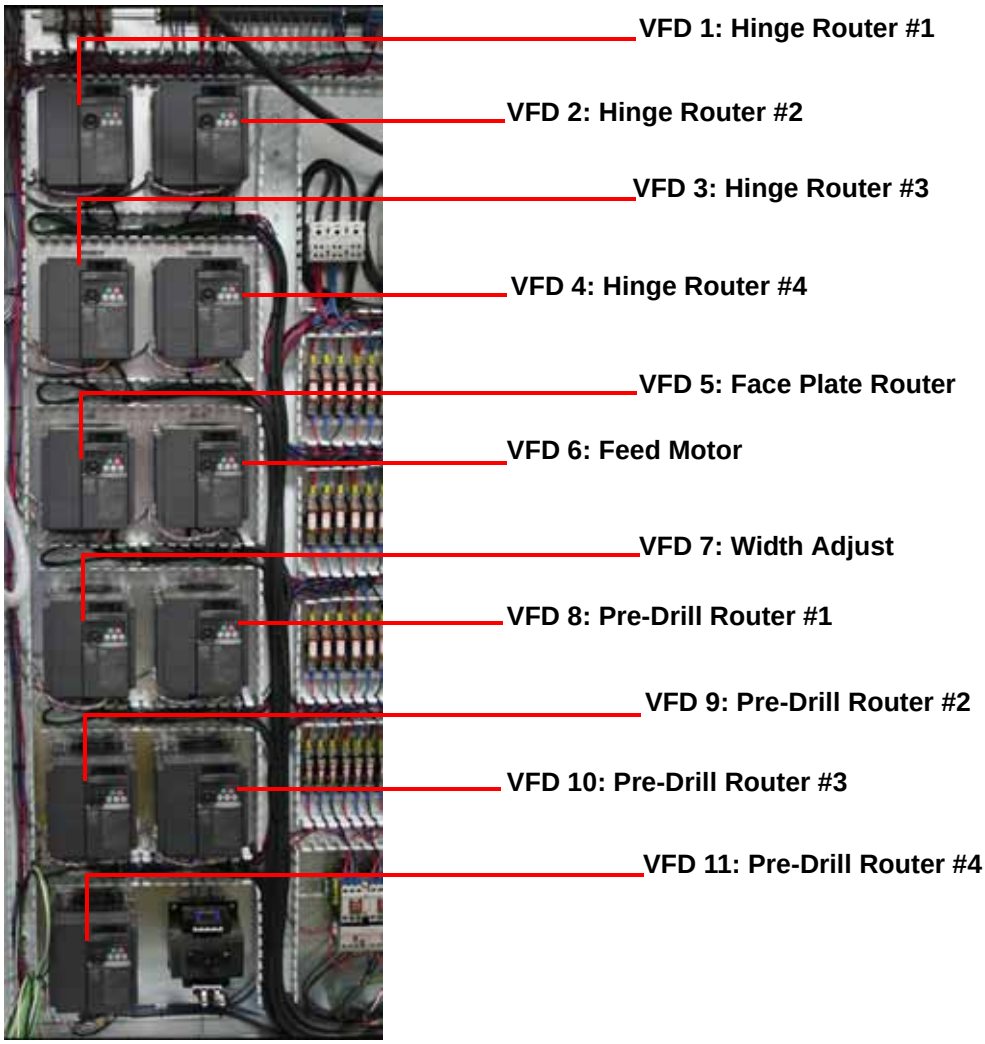


FIGURE 6- 19. Servo Drives

Connections to VFD's (High Freq Panel)

The Servo Drives are located in the Main Electrical Panel. The outputs connect to the following: For detailed wiring information, see your machine's electrical drawings.


VFD 1: Hinge Router #1
VFD 2: Hinge Router #2
VFD 3: Hinge Router #3
VFD 4: Hinge Router #4
VFD 5: Face Plate Router
VFD 6: Feed Motor
VFD 7: Width Adjust
VFD 8: Pre-Drill Router #1
VFD 9: Pre-Drill Router #2
VFD 10: Pre-Drill Router #3
VFD 11: Pre-Drill Router #4

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